

# PC MAGAZINE

VOLUME 6 NUMBER 7  
APRIL 14, 1987



12-MHz PORTABLE III:  
THE SMALLEST  
COMPAQ YET

## *12 Megahertz and Beyond: What Price Speed?*

- Number Crunching  
Like a Mainframe
- Become a  
WordPerfect  
Power User
- Programming:  
Pop-up Directory  
Within Any  
Application





# Turbo Basic™

## Introducing Turbo Basic, the high-speed BASIC you'd expect from Borland!

It's the BASIC compiler you've been waiting for. And it's so fast that you'll never have to wait again.

Turbo Basic is a complete development environment; it includes a lightning-fast compiler, an interactive editor, and a trace debugging system.

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“Borland has succeeded in stretching the language without weighing us down with unnecessary details . . . Turbo Basic is the answer to my wish for a simple yet blindingly fast recreational utility language . . . The one language you can't forget how to use. Turbo Basic is a computer language for the missus, the masters, the masses, and me.

Steve Gibson, InfoWorld

Borland's Turbo Basic has advantages over the Microsoft product, including support of the high-speed 8087 math chip.

John C. Dvorak 33

## Turbo Basic ends the basic confusion

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### Free spreadsheet included, complete with source code!

Yes, we've included MicroCalc, our sample spreadsheet, complete with source code, so that you can get started right away with a "real program." You can compile and run it "as is," or modify it.

### A technical look at Turbo Basic

- ✓ Full recursion supported
- ✓ Standard IEEE floating-point format
- ✓ Floating-point support, with full 8087 (math co-processor) integration. Software emulation if no 8087 present
- ✓ Program size limited only by available memory (no 64K limitation)
- ✓ EGA and CGA support
- ✓ Access to local, static, and global variables
- ✓ Full integration of the compiler, editor, and executable program, with separate windows for editing, messages, tracing, and execution
- ✓ Compile, run-time, and I/O errors place you in the source code where error occurred
- ✓ New long integer (32-bit) data type
- ✓ Full 80-bit precision
- ✓ Pull-down menus
- ✓ Full window management

### System requirements

IBM PC, XT, AT and true compatibles; PC DOS (MS-DOS) 2.0 or later. One floppy drive; 256K.

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**Turbo C: The fastest, most efficient and easy-to-use C compiler at any price**

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**Turbo C: The C compiler for amateurs and professionals**

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**Turbo C: a complete interactive development environment**

**Free MicroCalc spreadsheet with source code**

Like Turbo Pascal and Turbo Prolog, Turbo C comes

with an interactive editor that will show you syntax errors right in your source code. Developing, debugging, and running a Turbo C program is a snap.

**Turbo C: The C compiler everybody's been waiting for. Everybody but the competition**

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#### System requirements

IBM PC, XT, AT and true compatibles. PC-DOS (MS-DOS) 2.0 or later. One floppy drive. 320K.

#### Technical Specifications

- ☒ **Compiler:** One-pass compiler generating linkable object modules and inline assembler. Included is Borland's high performance "Turbo Linker." The object module is compatible with the PC-DOS linker. Supports tiny, small, compact, medium, large, and huge memory model libraries. Can mix models with near and far pointers. Includes floating point emulator (utilizes 8087/80287 if installed).
- ☒ **Interactive Editor:** The system includes a powerful, interactive full-screen text editor. If the compiler detects an error, the editor automatically positions the cursor appropriately in the source code.
- ☒ **Development Environment:** A powerful "Make" is included so that managing Turbo C program development is highly efficient. Also includes pull-down menus and windows.
- ☒ **Links with relocatable object modules** created using Borland's Turbo Prolog into a single program.
- ☒ **ANSI C compatible.**
- ☒ **Start-up routine** source code included.
- ☒ **Both command line and integrated environment versions included.**

\*Introductory price—good through July 1, 1987

#### Sieve benchmark (25 iterations)

	Turbo C	Microsoft C	Lattice C
Compile time	3.89	16.37	13.90
Compile and link time	9.94	29.06	27.79
Execution time	5.77	9.51	13.79
Object code size	274	297	301
Price	\$99.95	\$450.00	\$500.00

Benchmark run on a 6 MHz IBM AT using Turbo C version 1.0 and the Turbo Linker version 1.0, Microsoft C version 4.0 and the MS overlay linker version 3.51, Lattice C version 3.1 and the MS object linker version 3.05.

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*Mike Macewicz, Senior Decision Support Consultant, The Quaker Oats Company.*

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# thing out there. Nothing else league.”



## Diversified Grocery Products

Diversified Grocery Products is Quaker's second-largest profit center, with \$1,047 million, up 4.8 percent over last year. Overall operating income for fiscal 1986. Volume growth was paced by strong gains in *Quaker* *Bits 'n Bits*, *Quaker* *Bits* dry dog food and Food Service, partially offset by declines in *Quaker* beans, Canadian pet foods and canned U. S. pet foods.

Fiscal Years	1986	1985
Grocery Specialties	\$391.4	\$382.2
Pet Foods	329.2	329.2
Food Service	185.1	185.1
Canada	140.9	140.9
Total Diversified Grocery Products	1,047.6	1,047.6

## Grocery Specialties Division

Grocery Specialties includes *Quaker* *Bits 'n Bits*, *Quaker* *Bits*, *Quaker* *Bits* dry dog food, *Quaker* *Bits* canned U. S. pet foods, *Quaker* beans, Canadian pet foods and canned U. S. pet foods. In fiscal 1986, volume growth was 4.8 percent over last year.

*Gatorade* thirst quencher is a profitable product with strong recognition. Scientifically formulated to replace electrolyte balance during and after exercise, *Gatorade* meets the needs of today's physically active consumer dramatically over the last decade. That market growth in merchandising support caused *Gatorade*'s unit volume to gain follows outstanding increases each year since 1984. *Gatorade* thirst quencher is a highly successful product in the warmer months of April through September. This year, volume growth was 10 percent over last year. *Gatorade* is a highly successful product in the warmer months of April through September. This year, volume growth was 10 percent over last year.

# Microsoft WORD





## MELVIN O. DUKE Genealogy ON DISPLAY v.4.0, STAR FINDER ON DISPLAY & HOME INVENTORY

After 30 years in the computer profession, with genealogy as a hobby, author Duke took an early retirement to produce programs of value to others. As for his Genealogy ON DISPLAY programs he had this to say: "The experience (creation of ON DISPLAY) has been very challenging to me, personally, as I feel I could go anywhere in the United States, pick up a phone and call someone nearby, who would know me and would be happy to talk with me about the programs."

Genealogy ON DISPLAY v.4.0, written in BASIC, assists users in organizing, recording and reporting their own Genealogical Data.

The same care and attention to detail are found in author Duke's two other programs in the PC-SIG Library: STAR FINDER ON DISPLAY (display the Milky Way or a star of your choice) and HOME INVENTORIES (utilities for everyday, around the home use).

- ☐ 96.594 GENEALOGY ON DISPLAY v.4.0 \$12
- ☐ 447 STAR FINDER ON DISPLAY \$8
- ☐ 396 HOME INVENTORY \$8
- ☐ 5 PC-FILE, II Version 4, an excellent database manager for labels, inventory, and form letters \$6
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# SPEED LIMIT 16 MHz

## COVER STORY

### High-Speed ATs: Life in the Fast Lane

**Alfred Poor**/The advent of 12- and even 16-MHz ATs has made life a veritable autobahn for PC speed fanatics. The CCI ST/286-12, Wells American's A\*Star II Model 300, and the PC's Limited 286-12 and 286-16 are a hot-rodder's delight, breaking the 10-MHz barrier in fine style. But do the programs and network boards now on the market also travel well at these speeds? We'll alert racers to potential problems on the highway ahead ..... 119

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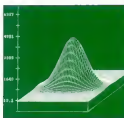
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Roberto Brosan

# WHAT'S INSIDE



Missing columnist

When a columnist or writer leaves a magazine, he usually disappears without a trace, something very much like MacArthur's old soldier. But Peter Norton and *PC Magazine* have too much history together for him to fade away without a formal farewell.

Peter Norton and *PC Magazine* started together. The Norton Chronicles (remember that name?) first appeared in the September 1983 issue (Volume 2 Number 4) with a discussion of PC languages.

Both *PC Magazine* and Peter have changed a lot since the early days of microcomputer publishing. Norton is now the president of Norton Computing, a thriving software development house best known for its wildly successful *Norton Utilities*. Norton just doesn't have the time to poke around under the computer's hood anymore.

Norton's monthly column about the technical innards of the PC evolved into an entire productivity section. Spreadsheet Clinic, PC Tutor, Connectivity Clinic, PC Lab Notes, Power User, User-to-User, and Programming/Utilities appear every 2 weeks and contain more than 300 pages of technical and productivity gems. For example, this issue's Programming/Utilities column, on page 313, gives you a free program that will pop up a directory listing within any application.

Our cover story this issue, "High-Speed ATs: Life in the Fast Lane," starting on page 119, looks at some of the most powerful computers that are on the market today: 12- and 16-MHz AT compatibles. As our cover implies, you need the right equipment when you want to go fast. The quest for speed requires higher tolerances and better quality control and holds forth the likelihood that if something does go wrong, you're going to crash. Of the four machines that we reviewed, all had some compatibility problems with add-in boards and networking software, suggesting that if your needs stray far from mainstream software you should proceed with caution. However, late-breaking news on a new release shows that the technology is not hopeless. The Compaq Portable III, reviewed in First Looks on page 33, runs at 12 MHz with no apparent compatibility problems.

Beginning on page 143, you'll find a special report on scientific applications for the PC: *Manuscript*, a technical-text formatter from Lotus; seven equation-solving programs; and numeric processors that put your PC's processing speed on a par with a super-minicomputer. And *WordPerfect* users can turn to page 221 for a complete rundown on how to effectively use the popular word processing software.

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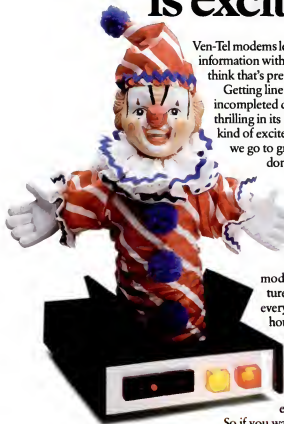
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# LETTERS TO PC MAGAZINE



## MEX-PC TALKS BACK

I would like to point out some errors in your review of our communications package, *MEX-PC* ("Asynchronous Communications: Shopping for Software," *PC Magazine*, Volume 5 Number 18).

The greatest error was in the Benchmark Tests chart, which implied that



*MEX-PC* does not support the Xmodem CRC protocol. In fact, our communications package has supported CRC since its inception in 1983, ahead of virtually all of our competitors. This omission was quite unfortunate; we feel *MEX-PC* would have excelled in this benchmark test because the program is written entirely in fast-executing assembly code.

The Summary of Features table accompanying the article also contained several errors: *MEX-PC* does indeed support unlimited repeat dialing; our remote feature does allow running DOS programs remotely; DEC VT-52 emulation is provided; RS-232C handshaking lines are not required; and, finally, *MEX-PC* does not include a built-in text editor, although you can easily add an external editor to *MEX-PC* by using its Shell facility.

Finally, I feel I must disagree with Mr. Stanton's claim that our documentation is poorly indexed. In fact, the *MEX-PC* manual is 240 pages long, with an eight-

page index spanning nearly 400 topics and more than 600 references.

Ronald G. Fowler  
President, NightOwl Software Inc.  
Fort Atkinson, Wisconsin

## HAPPY WITH THE CONVERTIBLE

I can't believe how apparent your dislike for IBM has gotten. What do you have against IBM? Did you get cut off by an IBM truck on the freeway?

A case in point is your treatment of the PC Convertible. Although its performance is on par with others in its class, it was not even reviewed in your recent article on laptops ("DOS Travels Better Now: What's New in Portables," *PC Magazine*, Volume 5 Number 22) because you considered it no longer new and never interesting. In addition, Peter Norton called it this year's biggest disappointment and you chose it as one of the worst products of 1986.

By constantly putting the Convertible down, you are misleading your readers about its capabilities. I had the good fortune of having an IBM Convertible and the Toshiba T1100 Plus on my desk at the same time, and in my own side-by-side comparison tests, I found their performance to be about the same. In addition, the Convertible has one of the most readable LCD screens, and its keyboard is ranked as one of the best. But even more important, the Convertible, unlike the Toshiba, is available.

What more could you ask for from a PC besides good looks? The Convertible is clearly the best-looking laptop of the bunch, while the Zenith Z-181 has to be the ugliest thing I have ever seen.

Daniel J. Lavato  
Lighthouse Point, Florida

Bill Howard, author of two reviews on the PC Convertible, replies:

*Readers often berate us for not liking PCs they already bought. They want PC Magazine to say, in effect, "Attaboy. You made a wise choice in your purchase of the Mount Fuji Shining Lotus Blossom PC, as this glowing review confirms."*

*While the IBM and Toshiba may seem to perform the same in informal tests, when they're benchmark-tested, the Toshiba is clearly faster. (That's why we have PC Labs: rigorous benchmark tests reveal more than anecdotal evidence.) The Convertible's biggest flaws are size and price: the parallel, serial, and external-video I/O ports that Toshiba, Zenith, and most everyone else includes, IBM sells as bulky, extra-cost clip-on slices. (IBM can't*



*even fit 640K bytes of RAM in the unit; it stops at 512K.)*

*The PC Convertible and eight other portables were reviewed in "DOS to Travel" (Volume 5 Number 13). In the follow-up of six portables that you referred to, "DOS Travels Better Now: What's New in Portables," we only looked at new or significantly upgraded machines. IBM's only change was to junk the idiotic "IBM standard" internal modem in place of a Hayes-standard unit.*

*The Zenith may or may not be ugly, but*

## ■ LETTERS

# Boost cursor speed. Stop cursor run-on.

With all the recent hoopla over performance, it's ironic that two of the PC's ergonomic deficiencies have been overlooked — its slow cursor, and the tendency of the cursor to remain in motion (run-on) after a cursor key has been released. Finally, the solution — Cruise Control™ from Revolution Software.

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*the screen is dazzling. Meanwhile, most readers should be able to fathom why the Convertible is readily available and the Toshiba T1100 Plus isn't.*

### AN ASSEMBLY DEBATE

I believe that Bill Machrone's column "The Death of Good Software" (From the Editor's Screen, *PC Magazine*, Volume 5 Number 20) was way off the mark. Although he makes many good points, he fails to recognize the opposing arguments.

Why wasn't MicroPro able to come up with competitive enhancements to *WordStar*, Version 3.3? I'll wager that it was precisely because it wrote the product in assembly code. Assembly code is inherently unmaintainable once the original programmer has left the company. Mr. Machrone confuses corporate confusion and dubious judgment at MicroPro with the issue of assembly language versus high-level language.

Warren Sirota  
Oakland, California

*The only "inherently unmaintainable" code is sloppy, poorly commented, spaghetti code—in any language. Much of WordStar's code happens to be so good that legions of nonprofessional programmers have been able to tweak lots of extra performance and features from it.—Ed.*

In response to "The Death of Good Software" (From the Editor's Screen):

*WordPerfect* was originally written in 1980 for a Data General C/300. At that time, we had to be very frugal with memory and cycles so that the accounting departments wouldn't complain when *WordPerfect* was added to their system. Consequently, we wrote the program in assembly and it ran in less than 64K bytes of RAM (40K bytes were shared code).

When we started work on the PC version, we looked at C seriously. Our decision to use assembly again wasn't difficult, since a mature version of C didn't exist in March 1982.

Today we are glad we didn't go to a higher-level language. Our memory requirements are generally lower than those of our competition, and we're generally faster, even though we do more formatting on the screen than other word processors. I

admit we are working on a C version for machines like the NCR Tower, but most of our software will continue to be written in assembly. We will not stop writing "tight, well-written code." Yes, an assembly programmer is part of a dying breed, but at least a few are alive and well.

W. E. Pete Peterson  
Executive Vice President  
WordPerfect Corp.  
Orem, Utah

### RIGHT ON COURSE

The timing of the publication of some of your feature articles is uncanny. My wife is an accounting major, and many of the articles have proven to be very useful to her toward the completion of her computer projects. In fact, it often seems the information she has so desperately searched for is published in *PC Magazine* just in time to complete a project. Can you please keep this up until May? With your help we may get her out of school yet.

Jerry E. Chancey  
Houston, Texas

*If you liked our past features, you'll love our special on business management slated for publication in late August—perfect reading for a CPA.—Ed.*

### ENTER ESCAPE WITH EDLIN

"Mastering Your Printer's Options," by John Dickinson (PC Lab Notes, *PC Magazine*, Volume 5 Number 19), misinformed your readers by stating that EDLIN cannot be employed to enter the escape character into files containing printer control codes. The sequence of Ctrl-V followed by the Left Bracket key instructs EDLIN to perform this function.

Dean A. Davis  
Long Island City, New York

*You are correct. What Mr. Dickinson meant was that Escape cannot be entered directly. Ctrl-V followed by the Left Bracket key will enter Escape, just as Ctrl-V followed by a character will input the desired control character.—Ed.*

### A TOUCH OF HUMOR

I just received my second issue of *PC Magazine*, and while I must confess I don't understand many of the articles, I am



# "Dac-Easy Accounting staged an astounding coup in the accounting category..."

PC WORLD  
October 1986

**150,000** and more every day. That's how many smart buyers have already chosen to save thousands of dollars in their decision to computerize their books. Recently the readers of PC World confirmed this new trend in accounting software by voting Dac-Easy Accounting as their favorite, outperforming the second place finisher with over five times as many votes.

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Journal of Financial Accounting, 1985

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PC Week, August 27, 1985



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## FIVE NEW MODELS

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Print Master from BayTech is an intelligent printer controller that connects between your computers and printers. It allows you to share one printer automatically, contend for multiple printers automatically, or switch between several printers by sending a simple code, not by changing cables. Plus, Print Master's generous built-in buffer spools data until your printers can receive it.

Because Print Master is a very flexible device, you can set it up to fit your application, even if your application changes.

## YOU SET UP THE IN-OUT PORTS

You configure Print Master's ports for any combination of printers and computers by answering questions from easy-to-follow menus. For example, with the ten port Print Master, nine computers can share one printer, eight computers can share two printers, seven computers can share three printers, and so on, to one computer which can share nine printers. You can also menu-select the disconnect time-out, form feeds, etc. and on serial models, the configuration of individual ports to translate for printers and computers using different configurations.



## 512K OR ONE MEGABYTE BUFFER KEEPS YOU WORKING INSTEAD OF WAITING

Since Print Master can accept data faster than your printer (up to 19.2KB serial or 5,000 characters per second parallel), you can send a print job to Print Master's standard 512K buffer and then go on to another project. All users connected to Print Master can send data to this common pool buffer, and they can be doing it simultaneously, even if no printer is available. Data is stored in the buffer until it can

be sent on a first-job-in-first-job-out basis to the selected printer. If you need more memory than 512K, Print Master is optionally available with one megabyte buffer.

If several users are sharing one printer, printer sharing via Print Master is completely automatic. There are no codes to send. You simply perform your normal print operation. If you are sharing several identical printers, connection is also

automatic. Again, you perform your normal print operation and are connected to the next available printer on a first-come-first-serve basis. Print Master will send data to all printers simultaneously to keep your printers running at full capacity.

If you are sharing several different printers, such as a laser-jet, a dot matrix and a plotter, and you wish to select a specific printer, you do your normal print routine and also send a printer select code (which you can define yourself) before the first characters of your data. The data is then routed to the selected printer. It's that easy.

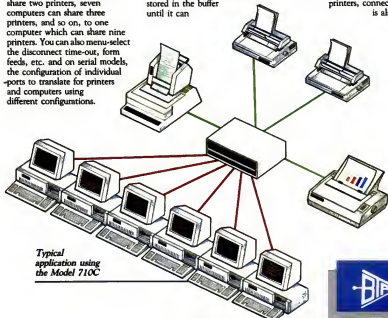
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# "Dac-Easy Base Lives Up to Its Name, Sets New Low-Cost DBMS Standard."

PC Magazine  
March 10, 1987

**\$49.95**



## A Powerful Relational Database That's Easy To Learn, Versatile, Very Affordable, And Much More.

Dac-Easy Base is indeed both powerful and easy to use. It offers a multitude of unique features to help you organize, locate, and sort all kinds of alphabetic and numeric data. Dac-Easy Base continues the low price/high performance tradition of the Dac-Easy Series. With worldwide sales of over 300,000 systems, Dac-Easy has become the new leader in software designed for small businesses.

### Flexible Menu System

Dac-Easy Base is actually two systems in one. If you are a novice you will appreciate the special Beginner Menu which contains the most commonly used features for creating, editing, and printing files. The more experienced database user will find the Advanced Menu allows instant access to each and every one of the powerful routines. In both menus, you are only a keystroke away from the context-sensitive help screens. The help screens in Dac-Easy Base are so complete you may never have to consult the accompanying 200 page manual.

### Easy File And Report Creation

Design professional-looking data input screens without leaving the menu structure. There is no need for complex programming. Once created, the edit screen allows you to input and edit your information in a matter of minutes. Also attach special notes to any of your records with the built-in MemoWriter. The MemoWriter is the perfect way to attach specific information to a single record. Custom reports are easy to create without using the available

programming language. Column or page-style reports can be created quickly and viewed on your computer screen or printed to paper. As with all reports generated by Dac-Easy Base, you can select which records will be included in your report and how they will be sorted. Special headings and subtotals can be added to give you the exact information you need.

### Great For Advanced Users

Yes, Dac-Easy Base is easy to use, and it is also very powerful. An unlimited number of records with up to 60 fields per record, ability to access up to three files at a time, date arithmetic capability, formula fields for calculations within files, dynamic abbreviations, and keyboard macros are just a few of the powerful features available at your fingertips. Dac-Easy Base can read and convert dBASE II files and can run dBASE II programs.

### 30 Day Money-Back Guarantee

Dac offers a 30 day unconditional guarantee on all products bought directly from Dac Software (less shipping charges). There is a \$10.00 restocking fee if the disk envelope is opened.

### Minimum Hardware Requirements:

IBM or other compatibles, 256K memory, MS-DOS or PC-DOS 2.0 or later, two 5.25DD drives, color or monochrome monitor.

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"Dac-Easy Base is similar to dBASE II in appearance, yet it improves upon it in ease of use, system limits, on-line and contextual help, numeric accuracy to 15 digits, security by password, storage of more and larger memory variables, and on-screen report layouts. The program can interface with dBASE II files and emulate its dot prompt, though Dac-Easy's menus are the better matrix."

Everyone will be pleasantly shocked by its \$49.95 price."

PC Magazine  
March 10, 1987

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CIRCLE 470 ON READER SERVICE CARD

## LETTERS

learning. In fact, I just learned that an AT is a souped-up version of a PC! (Yes, some of us are that ignorant of computers.)

I particularly enjoy reading the Viewpoints section of the magazine. The contributors write in a very enjoyable style that's down-to-earth and often humorous. For example, in Peter Norton's column (*PC Magazine*, Volume 5 Number 17), he mentions that we can expect to see some "advanced operating systems" and concludes by saying: "But, the most important thing is (*drumroll*) it doesn't matter (*cymbal crash*)." Wonderful!

It is so good to see that in a generally serious and stuffy business world like ours, some people enjoy chuckling and helping others do the same.

Therese Sachnik  
Gainesville, Georgia

## THE BEST AND THE WORST

Regarding your selection of the PC's Limited 286/16 as one of the best of 1986, I suggest that you move it to the list of "The Best Vaporware of 1986" ("The Best of 1986 (And Some of the Worst)," *PC Magazine*, Volume 6 Number 1). While your staff may have had ample opportunity to test this "extraordinary" machine courtesy of the manufacturer, you should know that PC's Limited has chosen not to make the 286/16 available to the paying public for the foreseeable future. After several calls to the company, I found out that the 286/16 would not be released until the stock of 286/12s was depleted!

Even if you get your machines for free, somebody at your magazine should have noticed that PC's Limited never mentions the 286/16 in its advertisements. When your staff generates this much interest in a product, you owe it to your readers to make sure the product is available.

James W. Hughes  
Albany, New York

According to Michael Dell, president of *PC's Limited*, "Production of the 286/16s is behind schedule."—Ed.

In the sidebar "Manufacturers' 1986 Efforts: Cheers and Hises" ("The Best of 1986 (And Some of the Worst)," you mentioned that Symantec issued free updates of Q&A to everyone who purchased

the first version (Version 1.0). This is not true! I got hooked for \$50 for my Version 2.0, and this after having helped Symantec identify a serious bug in Version 1.0.

Robert W. Houskamp  
Grand Rapids, Michigan

*You are correct; Symantec did charge registered users of Version 1.0 a \$50 fee to upgrade to Version 2.0. However, the first upgrade to Q&A—Version 1.1—was sent to users free of charge. As we reported in the sidebar, this upgrade included a spelling checker and better printer support. If you are a registered user, you should have received this free upgrade long before Version 2.0 ever hit the shelves.—Ed.*

## CORRECTIONS/AMPLIFICATIONS

For information on Datapac's OCR and OCR Plus (First Looks, page 52, *PC Magazine*, Volume 6 Number 1), the correct phone number is (415) 965-7900.

In addition to the Hewlett-Packard LaserJet, The Laser Connection's PS Jet will also upgrade the QMS Kiss, Big Kiss, and NCR 6416 ("The Best of 1986 (And Some of the Worst)," *PC Magazine*, Volume 6 Number 1). The only requirement is a Canon CX engine with an internal power supply.

The Video-7 VEGA Deluxe board no longer comes with a copy of Microsoft Windows as reported in "Stretching the Standard: Seven New EGA Boards" (*PC Magazine*, Volume 6 Number 1).

## HOW TO WRITE TO PC MAGAZINE

Do you have a comment, compliment, or criticism about something you've read in *PC Magazine*? A question you'd like to open up to other readers? Then send your opinion on paper or disk to Letters to *PC Magazine*, One Park Avenue, New York, NY 10016, or send your opinion through MCI Mail to PCMAGAZINE at address 157-9301. We're sorry we're not able to answer letters personally.

All letters become the property of *PC Magazine* and are subject to editing. We cannot publish letters that do not include a name, address, and phone number for verification.

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**EDUCATION 5**—Learn Ograms, the Japanese art of paper folding. Color required  
**FINANCES 3a,b**—(2 disks) Express Calc 3.12, a powerful spreadsheet program  
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CIRCLE 302 ON READER SERVICE CARD

# 10 BIG REASONS IT'S TIME YOU CHANGED YOUR EDITOR TO BRIEF

**1 FUNDAMENTAL TRUTH.** If you are a programmer, you use your editor more than any other tool. If it isn't the best, the fastest, the most versatile, the most productive, well, then neither are you!

**2 OUR ENTHUSIASM.** While we do not publish BRIEF we wish we did. We sell so many BRIEFs that we've been advertising a non-stop since it was introduced two years ago. We're not alone in our enthusiasm. There is no end of accolades from other admirers

## BRIEF Encounters

"The word is getting around that BRIEF is simply the best text editor you can buy. John Dvorkin in *InfoWorld*."

"In the last five years, only a handful of applications have altered the way we use microcomputers. The winners' impact is astounding. BRIEF is a 'winner' that will most definitely change the way we develop application software. *Data Based Advisor*."

"Overall, BRIEF is an excellent and efficient editor with capabilities that are truly useful. If you're a serious programmer or developer of commercial applications, the BRIEF/dBRIEF package is one of the best investments you can make." *PC Magazine*, 7/86

"Every time I've mentioned text editors I've got a call of said using me to try Brief! Now that I've tried it I see why it has windows—boy, does it ever have windows! It did just about anything you want to. I look no further recommended." *Jerry Pourmeille*, *Byte* 12/86

Best editor of 10 compiled  
Dr. Dobbs's Software Tools

**3 WINDOWS ON THE WORLD.** Why the excitement? First, BRIEF's architecture. Any number of files of virtually any length can be open. (Start brief with "\*,\*" to prove it.) Open as many tied windows as fit the screen—over/under and side-by-side—to work on any of your files. Open, close, and rename windows as you go. In each window, full screen or tiny, all editing techniques are at hand—high-speed scrolling, paging up and down, horizontal scrolling, optional word wrap. Load the same file in many windows to view different areas simultaneously. A change in one changes all. Cut and paste text blocks between windows and files, or into buffers for later recall. All files stay in memory, so you can always go back to snip some more.

**4 UNDO. NOT UN-DELETE.** Don't confuse the two. BRIEF doesn't just keep snapshots of recent deletions; you should be able to pick them up from the cutting room floor. It can reel the whole film backward undoing any command that affected the cursor or the text. Watch it undo a global replace, for example. Uncanny, it can back up 300 times, all the way to the beginning of a session. "Works like a dream," said *The C Journal*.

**5 WHOLLY MACROS.** Much of BRIEF was written in its own macro language. It is that powerful. The language and its compiler

come with every copy, as do many standard macros, with source code for learning by example. It is a complete language with conditionals, loops, recursion, global and local variables, even data types. It can control files, windows, and the keyboard. It has structure, 32-character variable names, and—not at all like 1-2-3's cuneiform—is entirely readable, like a hybrid of LISP and C. With it you can develop a library of routines to power BRIEF your way.

**6 SHELL GAMES.** Leave BRIEF, run your compiler, print out the error messages, load up BRIEF again? No way! Run your compiler from inside BRIEF! It will point to each error line in your source program, still loaded in memory, for immediate editing. You don't have to leave BRIEF to use DOS either. BRIEF disappears from the screen to get out of your way, but say bye to DOS and BRIEF pops back to the screen, as do all the files you were working on.

**7 KEY WHIZ.** You can reassign BRIEF's command keyhits to whatever keys you're used to, even your old editor's, so you don't have to send your fingers back to school. Macro execution can be assigned to single keys. Or you can tell BRIEF to listen while you tap out a complex routine. It will save and playback faithfully, a shortcut macro without a single line of coding.

**8 MULTI-LINGUAL.** BRIEF's macro language is perfect for writing formatters for your language which indent, match up parentheses and brackets, and set up statement templates for full-in. BRIEF comes with C language support already built in. Others have written macros to format Pascal, BASIC, LISP, Prolog, FORTRAN.

**9 QUICKER PICKER-UPPER.** Looking for something? BRIEF has full UNIX\*-like expression search tools to forage and find and fix any file in memory. Literal strings with wildcards and "?" character masking, sure. But also indifference to case or intervening characters, [a-z] to match all vowels, or [^a-z] to match anything but vowels, [a-1-m] to match character ranges, beginning or end of line searches, even multiple choice pattern matching and replacement.

**10 REASONS 11 THROUGH 20:** 11. BRIEF comes with a color option you can select your own color scheme anytime. 12. It supports EGA's 43-line

## dBRIEF. The Power Environment for dBASE Programming

Many worthy utility products supply needs that dBASE's programming language doesn't—dUTIL, dFLOW, dBASE and a host of others. Trouble is, you have to use them separately, then combine their output into your dBASE program files.

No longer. dBRIEF, written in BRIEF's macro language, grabs hold of BRIEF and turns it into a complete dBASE III and III Plus programming domain. Using BRIEF's underlying shell capabilities and its own interfaces, dBRIEF can run external utility libraries, plus dBASE itself, and link to the Clipper™, Foxbase™ and Quicksilver™ compilers, all with dBRIEF still loaded and running the show. It can do what BRIEF already does plus

- Convert a screen layout into dBASE code for interactive data entry
  - Display dBASE file structures in windows, a great convenience alongside your program files
  - Expand keystrokes into full dBASE statements
  - Indent automatically for classic display
  - Create databases, index files, invoke Ashton-Tate's dFORMAT™ and dCONVERT™, draw lines and boxes
  - Simply marvelous programming environment for writing and editing dBASE programs". *PC Magazine*, 7/86. Source code included!
- Requires BRIEF 1.32 or later and 384K. 512K to run dBASE within dBRIEF. 640K and harddisk recommended.

mode and can display up to 128 lines long. 13. Full 8-bit ASCII display, the whole character set can show on screen. 14. Full path support. 15. Command line start-up flags to modify BRIEF's behavior, change a path name, or run a macro: for example "wp" which turns it into a word processor with wraparound and margin setting. 16. Automatic file save during idle moments. 17. Compatibility with most state-resident programs (like Siskelock™), multitaskers (like Microsoft Windows™), and networks. 18. A bulletin board with public domain macros contributed by a mushrooming cult of macromaniacs. 19. No copy protection. 20. Context sensitive help, and phone support from the publisher.

Now if that isn't every last reason why you should switch to BRIEF, here is the clincher. You can try out BRIEF for 30 days with no risk at all! We offer a no-questions-asked money-back guarantee. \* Enough reading. It's time for dialing.

You're sold! Call us at...

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List Prices: BRIEF: \$195, dBRIEF: \$95  
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**I**nteractive-C shows how far C interpreters have come. More than an interpreter, Interactive-C is a fully integrated development environment: a complete K&R interpreter, debug facility, and even editor, plus the best debugging facilities of any interpreter—say, Computer Language 2/87.

Since through-programming projects like a hot knife through butter, Debugging tools include breakpoints, watch values, stepping options and interactive viewing and modification of variables. An Interactive-C exclusive lets you step right to edit and "continue" from where you left off. Eliminates plodding replays of already debugged code.

Run Interactive-C using adaptable exit command and status windows. Toggle a second screen showing only your program's output—severely any crowded information. Or use twin CRTs. Load options for your computer functions or commercial libraries. Interactive-C has immediate mode, syntax checking both as you type and run, and cursor positioning that points precisely at an error.

Plus, you can port programs from Inter-Active-C to major computers with no modifications—91% 100% compatibility. Ask for DISK. List \$240 **PC Brand \$219**

## HALO GRAPHICS SYSTEM Multi-Board Graphics Library

The premier graphics library that got the ball rolling for PC-based graphics and has gone so computer that it supports over 25 graphics boards—including IBM's EGA and Mx 8 Revolutions in the series—and has a multitude of mode and printer drivers. All that in each box. Separate C versions for Lance, Mostek, Aztec, CIBS. What does Multi-Board do? It drives to the last pixel; graphics library programs to reset drivers as distributed program can run on anything. Wonderful value for single license. Costly royalties through for redistribution. Specify 3025 as language. List \$300, Mx \$239. With Dr. Halo II, a free-standing "parts" List \$440, Mx \$299.

## dBc Lattice Library Maintains dBASE Compatible Files With the Power and Speed of C

**d**BCTM links C to dBASE. It creates and maintains files and their indexes which can regulate dBASE file design. So dBASE can read and update them. And the reverse: dBc can use any files created by dBASE. Now C and dBASE can operate on the same data bases interchangeably. That opens up the widespread culture of dBASE installations to exploitation by C programmers. Tap that market, and the resident dBASE language, and gain the advantages of C with this simple product. dBc's functions parallel all dBASE's file handling commands, many decomposed to give closer control. Each backed by demo source files or disk.

## WINDOWS for C/WINDOWS for DATA

Microsoft Windows™ and TopView™ Compatible

**W**indows for C™ has a library of over 80 functions to aid the power and practicality of window partitioning to your application. Unlimited windows, each defined in a C structure for easy reference throughout your program, can be made either to pop up or permanently overlay the screen. Routines will scroll and highlight lists with arrow keys, will read and scroll ASCII files vertically and horizontally in windows, and even write to memory-loaded files off the screen.

Logical treatment of video attributes permits unobscured programs to run on color or monochrome. Colors of windows are set individually.

All functions are in separate modules, only those used are linked. Only buffers loaded on-screen or temporarily obscured windows occupy RAM; others released dynamically. Best overall rating and fastest delivery in Bill Hurt's 7/85 Tech Journal review of five windowing products. **Windows for Data** comprises all of Windows for C but takes in data through the windows as well. At the high level a single function lets you specify prompt, field length, data type, screen location, picture target variable; then sets lesser functions according to get and process a user's input. There are utilities to get system date and time, mess with strings, create your own made-for fields.

Field options can require entry, power entry, permit select or overwrite, beep on invalid or overflow keypresses and attachment of field-specific help messages and functions you want called to display messages or validate entries. And you decide which keys will clear a field, jump to the next or past, quit, etc. Options diverse enough that a set of "fields" can be made to behave like a Lotus™ menu.

Specify Compiler: PC Brand \$159  
T0150 Windows for Data \$295  
T0150 Windows for Data \$295

## MICROSOFT C 4.0

A Great C Battle Rages and You're Winning

**A**s the dreadnoughts pound each other with ever heavier ordnance, today's programmers rear the spouts of their war: building a source debugger and a "mule," and sporting a "huge" memory model; persisting single data objects larger than 64K; the Microsoft C compiler has ramped a full version number to 4.0. But what's really impressive are the benchmarks reported in Dr. Dobbs (8/85) encyclopedia survey of 17 C compilers. Microsoft's and IBM's C (themselves from Microsoft) ran away with the contest winning 11 of 27 benchmarks.

The CodeView™ debugger, free for a limited time, uses windows to show everything on one screen: source alongside disassembled object, variables, stack and registers. Drop down windows—use a mouse if you like—abovate learning of commands. A source-level debugger that puts the rest to shame? (Dobbs).

## 30-DAY MONEY- BACK GUARANTEE

We refund the purchase price of any product returned within 30 days in entirely reasonable condition. You can even try out programs themselves if product code begins with E, T or L through N—eventually means breaking the disk seal. Some developers do pose limits, so for product disks beginning with other letters opening sealed disks constitutes acceptance. But you can at least check the manual. There's just nothing stopping your buying from PC Brand.

Microsoft C now has free memory models for code and data, plus non-library support for another thousand, and boasts alternate math packages for speed versus accuracy, with or without 8087/80387 chips.

Both linker and library manager are part of the package, as is the "mule," a UNIX™ name for a smart batch program which knows to expand minimum effort to rebuild any size of project by compiling and assembling only elements affected by new or changed modules.

It is reportedly used by Lotus, Ashton-Tate and, fittingly, Microsoft itself to develop Windows. Dobbs says that MS-DOS C development environment value today (8/85) virtually any kind of program conservative: 330K suggested.

Ask for: T0500  
List: PC Brand \$450  
\$295

## C-TREE & R-TREE

**C-tree:** The only major b-tree file manager that comes with built-in network support rather than a costly separate version, C-tree™ is sturdy code that has weathered many seasons of prolonged and widespread use. It comes in C source, so you can modify it to fit a special case, permits any number of keys for a data file—alpha, numeric, even floating point, handles files with varied record lengths, and multiple keys in one index file. In short, you get the works—and there are no royalties.

## B-Tree File Manager Now Has Report Generator

C-tree's design splits nodes to allow any number of users to access an index file simultaneously even when updates are in progress. So multi-user config—unavailable for other networks—are possible. Forward-looking features are provided for DOS 3.x, UNIX, XENIX. C-tree can travel. Tests in many environments prove that C-tree gives your application a taste to anywhere.

**r-tree:** thousands of c-tree users (and you) now have a suddenly expanded ability to produce ad hoc reports from the field characteristics of the data files to code; usually entitled.

Once you link a description of the field characteristics of the data files to

a tree library, you are free to use an ordinary text editor to write any new report script with no further C coding. Reports can access data in several files, select to match complex searches, join the findings into new logical records, sort them, calculate new fields and columns, tabulate by any number of control breaks. Your script files show visual representations of report images—not just rows and columns, but customized layouts.

r-tree™ comes in source code and is designed for the same portable C compiler. Fits any compiler.

c-tree F060 \$395  
r-tree F066 \$295  
Combined F066A \$541

## PANEL Feature-Laden Screen Design Tool

**W**atching your own screenware can blow completion dates and profits. PANEL™ helps you to interactively set up foolproof screen displays and data entry forms rapidly. Update to C source code.

Not just simple panel-layer your screen with pop up or on-overlaid images. Background pop-up lists, help boxes, and alternate input fields.

Panel builds in a user interface for keyboard movement within and between fields, supplies validation routines for

checking user field entries. Diverse attributes may be selected for any field—size, data type, color, comparison of input to upper case, clearance of existing data when new entry is started, masks for standard formats (eg, dates), phrases which fill in when their list is typed, multiple choice lists which can be chosen by cursoring a highlighted bar. Fields may be multi-lined and scrolled at will. The screen space allotted there. Specify 30400 C Compiler List \$295, Mx \$229.

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## GREENLEAF <sup>Bountiful Harvest</sup>

C source, assembler, source and binary libraries of 225 functions for many compilers. Emphasizes full functional groupings to maximize loading code which your application may never use. Manual helps select functions, bulletin board, too.

A sampling DOS estates for file and directory manipulation. Screen to select code page, monochrome or color palette, cursor shape, positioning, clearing and scrolling, post and cut, read light pen. Stores. Center, justify, etc., efficient left operators which add, delete, sort string padding between and "wide" and "space" character positions, keyboard status, function key assignment, time/date, read sequences and memory size peek and poke. Manual best available. **Specify 50700 & Compiler List \$95. Hrs. \$139**

## SUPER SOURCE!

### Aldebaran's Source Print

Structure is handy but, face it, hard to find your way around in. Source Print is options can print your programs adding page numbers and headings, those mysterious line numbers your compiler refers to, vertical lines connecting "begin" and "wide" and curly brace structures (however long or nested, indents automatically so you needn't bother) and throws in a table of contents and cross-reference index for good measure! Leaves a truly professional audit trail. Occasionally a utility comes along that makes a programmer's life much easier. Source Print is such a program. **PC Magazine 5/89. Ask for H0005 List \$75. Cms \$90**

### ...and Tree Diagrammer

Prints an organization chart of your program's structure showing the hierarchy of function, procedure and subroutine calls. It's a glance what you can call each other for clearer debugging. Easy-to-use menu with point-and-click file selection. Ask for H0007. **\$85. Cms \$45.**

## GREENLEAF <sup>Hello World</sup> COMMUNICATIONS

What your application to communicate with other or remote data bases by asynchronous communications built into any user's C program? Even if you don't need it now, that's a skill to have at the ready! 120 functions and demo programs in both C and assembler source code set up separate transmit and receive ring buffers for up to 16 simultaneous channels. Interrupt driven so you can halt an ongoing transmission, a file or the user, if you wish, then continue. Coodie-style communications software.

Supports up to 9600 baud, ASCII or binary, any parity or word length, RS232C, UARTs, Xon/Xoff and Xmodem. Width/track record. **Specify 50700 & Compiler List \$95. Hrs. \$139**

## RUN/C Interpreter Links Binary Libraries

Run/C Professional™ has a screen interface as simple as PC BASIC with full screen editing and familiar commands like L&O, D, T, M&C, even TRON and TRACE. Just write and RUN.

Best of all it dynamically loads potentially any major commercial function library compiled with Lattice's Lattice model (512K recommended and Lattice C required for external libraries). Less more features, system interrupts a simple command C or Creative Programming system command without exiting, built-in debugging aids. Ask for S0800 List \$250. PCB \$185.

## DAN BRICKLIN'S DEMO PROGRAM Storyboard Your Program

The Legendary One has created a Menus/Trees view of the use of our set on Zero. Dan was the original electronic spreadsheet (VisiCalc™). This one is for programmers.

Words don't express program ideas better than pictures or screens. Dan's Demo creates slide shows. Create a screen — a snapshot of your planned product as it runs. Anything goes, words, borders, box lines, arrows and underlining of monochrome, fore- and background color. Copy this "slide" to an empty screen. Change it a little to show the next instant of run-time. Do it again. Press to choose slide show of your program in action.

All 250 characters and attributes are available from scrollable lists which pop to the screen. All commands are layered in Lotus-style pop-up menus. Frequent choices mapped to function keys as well.

80x25 character mode, not to be mapped. Screen areas can be locked for cut and paste or filled with color or characters, even blink. Slides can overlay on others, can be shifted, deleted. Slides can proceed at time intervals or branch anywhere in the slide sequence depending on user keyhits.

Invaluable to prototype the program you are about to write to position the labels, choose the color decore, arrange out the keyboard interface. Or load the "capture" utility and snapshot the aspects of any running program for an instant slide show. Each copy entitles you to redistribute any of the slide projector program that runs demos. Plain manual, no binder keeps price of big product small. Might become the essential tool in user interface prototyping. Tech. Info. Ask for N0000 List \$75. US \$69.

## BASTOC <sup>OPTIMIZES!</sup> Translates BASIC Into C

For a trifling price, BASTOC™ moves the muscles of BASIC to the new C. It is a translator which takes in Microsoft Extended BASIC and emits pure K&R C for Lattice 3.0. It will optimally convert your program into a simple monochrome C function or declare it into separate functions, one for each C8086 label.

Version 2.0 optimization dramatically reduces execution time. Converts to in hopes those variables in BASIC programs which do not need floating point. Where BASIC uses full assignment statements to increment counters, BASTOC converts to C code from. Strings dynamically allocated adding your application of BASIC's callous habits for garbage collection. Creates structure of even-compiled BASIC code. Huge workbooks. Ask for List PC Board 50375 \$495 \$399

## Shopping List for the Power Workbench

ASSEMBLERS & DEBUGGERS		LIST		WINDOWS for Data includes Windows for C	
Advanced 86-88 Morgan, ASM interpreter	145	99	115	295	259
Codemeter 86 Debugger by Visual Age	145	99	115	295	259
CSD Debugger C source level by Mark Williams	75	35	130		
C-Sprite Debugger by Lattice, source level	175	130			
Microsoft Macro Assembler with Utilities	150	109			
PASMAN by Phoenix, source level	295	235			
Periscope I Debugger Data Base Decisions	129	99			
Periscope II Data Base Decisions	129	99			
Periscope III software only	295	235			
PinPoint Plus by Phoenix, Symbolic Debugger	295	235			
BASIC LANGUAGE		LIST		GRAPHICS	
BetterBASIC: Sammi Software	195	185		250	210
8087 Math Support	99	85		495	375
Binary interface	250	235		495	375
Run-Time Module	350	295		495	375
Microsoft BASIC Interpreter for XENIX	99	78		495	375
Microsoft QuickBASIC Compiler full BASIC	99	78		495	375
Professional BASIC by Morgan	150	99		495	375
True BASIC True BASIC inc.	150	99		495	375
Run-Time Module	150	99		495	375
C COMPILERS		LIST		UTILITY LIBRARIES	
C-86 Compiler, custom conventions	395	289		175	117
Lattice C Compiler from Lattice	500	299		175	117
Let's C Compiler by Mark Williams	75	35		100	67
Let's CSD Source Level Debugger	125	80		100	67
MWC-86: Mark Williams C Development	495	399		100	67
Microsoft C Compiler 4.0	450	295		100	67
C INTERPRETERS		LIST		Blaise C Tools Plus	
C-Trap by Gimper Software	300	249		175	117
Instant C by Relational Systems	350	295		100	67
Interactive-C by IMAPAC with debugging	249	199		100	67
RUN/C Professional from Lattice	250	185		100	67
RUN/C without Lattice Libraries	120	109		100	67
TEXT EDITORS		LIST		Blaise C Tools 2	
Brial from Solution Systems	195	185		100	67
Edix by Emerging Tech., Multi-screen	195	185		100	67
Epilition by Luger Software, like EMACS	195	185		100	67
FileTime by Spruce Technology, C syntax	295	235		100	67
Kedit by Mansfield, similar to Kedit	125	99		100	67
LSE, the Lattice Screen Editor Multi Window	125	100		100	67
Pratt by Phoenix, multi-window	125	100		100	67
Text Management Utilities Grep, split, diff, etc.	120	100		100	67
Vedit by Computer	150	99		100	67
Vedit Plus by Computer	185	129		100	67
FILE MANAGERS		LIST		Blaise C Tools 3	
Blitview by Softcraft, no royalties	250	195		100	67
Blitview Network by Softcraft	595	485		100	67
FileTree by FairCom	295	235		100	67
C-Tree of FairCom-Report Generator	295	235		100	67
C-Tree 2 & 3 Tree Combo by FairCom	500	341		100	67
dBC, from Lattice, maintains DBASE files	250	195		100	67
FileTree by Spruce Technology	295	235		100	67
gBC in Plus, supports multi-user DBASE	750	595		100	67
with source	1500	1185		100	67
dbase utility user DBMS by Ramax	495	399		100	67
dbvista multi-user DBMS	495	399		100	67
Opt Tech Sort Can sort Blitview files	140	105		100	67
SCREEN DESIGN		LIST		Blaise C Tools 4	
Cursor by Lattice, UNIX screen design	125	99		100	67
with source	250	185		100	67
Greenleaf Data Windows...New	225	169		100	67
with source	395	279		100	67
On-Line help from Qui-Tech Data	140	105		100	67
Panel by Roundhill, no royalties	295	235		100	67
View Manager for C by Bryant	275	185		100	67
Visual C by Creative Programming	225	169		100	67
VC Screen by Creative Programming	100	61		100	67
Windows for C Vermont Creative Software	195	149		100	67
OTHER LANGUAGES & UTILITIES		LIST		Blaise C Tools 5	
Microsoft COBOL Compiler	995	795		100	67
Microsoft COBOL Compiler for XENIX	995	795		100	67
Microsoft COBOL Tools with Source Debugger	350	259		100	67
Microsoft COBOL Tools for XENIX	450	333		100	67
Microsoft Lisp New Code Generator	250	195		100	67
Microsoft MultiMath includes MuSimp	300	199		100	67
Microsoft Pascal Compiler Lnx with M'soft C	300	199		100	67
Microsoft Pascal Compiler for XENIX	295	195		100	67
PDisk Phoenix's new disk manager	195	125		100	67
RWCOBOL by Ryan McFarland	950	740		100	67
RWCOBOL 6X ANSI 85 COBOL	1250	940		100	67
Source Print, source code formatter	60	45		100	67
The Diagrammer...source code programmer	55	45		100	67
HelpControl by MDS...f23 style Help	125	105		100	67



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1978  
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### Laser 128 \$379 List \$479

#### Apple II, IIe, IIc Compatible

- 128K RAM, 32K ROM
- Enhanced Keyboard
- Serial Modem, Printer Ports
- Parallel Port
- Internal Floppy Drive
- Mouse/Axisport Port
- Expansion Slot
- Central Port "Copy II"

Assembled and Tested Laser 128 Systems

With 17" Amber Monitor	3,400	\$445
With 21" Amber Monitor, 2nd Disk Drive, Printer	3,135	\$415
With 17" RGB Color Monitor	\$3,800	\$778

Configured and Tested Systems:

1.31" 160K Drive, for a G2, Mac II	1,430	\$18
1.31" 160K Drive, for a G2, Mac II	1,430	\$18
1.31" 160K Drive, for a G2, Mac II	1,430	\$18
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1.31" 160K Drive, for a G2, Mac II	1,430	\$18

### Conroy-LaPointe XT/Model 2" Turbo \$545

- IBM PC/XT Compatible
- Dual Speed 8.0/4.77 MHz Processor
- 256K RAM Expandable to 640K on Motherboard
- 256K Floppy Drive
- 8 Expansion Slots
- AT Style Keyboard
- MS-DOS 3.1
- FCC Class B/UL Approved
- Limited Warranty: 1 Year Parts & Labor

### Conroy-LaPointe XT/Model 2+ Turbo \$595

- Same features as above, with Zero Watt State

Configured and Tested Systems:

160K Systems with Mono Graphics Card & Monitor	\$760 (Model 2) / \$810 (Model 2+)
Above 160K Systems with 20MB Hard Disk Drive	\$1,160 (Model 2) / \$1,190 (Model 2+)

### Conroy-LaPointe AT/Model 16" \$1250

- IBM PC/AT Compatible
- Dual Speed 8.0/6.0 MHz Processor
- 512K RAM Expandable to 1.0MB on Motherboard
- 1.2MB Floppy Drive
- Space for 1 more Floppy Drive or Tape Backup
- Space for up to 2 Hard Disk Drives
- AT Style Keyboard
- FCC Class B/UL Approved
- MS-DOS 3.1
- Limited Warranty: One Year Parts & Labor

### Conroy-LaPointe AT/Model 18" Turbo \$1325

- Same features as above, with Dual Speed 10.0/8.0 MHz Processor

Configured and Tested Systems:

1.2MB Systems with Mono Graphics Card & Monitor	\$1,470 (Model 16) / \$1,485 (Model 18)
Above 1.2MB Systems with 20MB Hard Disk Drive	\$1,715 (Model 16) / \$1,730 (Model 18)
1.0MB Systems with 30MB Hard Disk Drive, EGA Card & NEC Multisync Monitor	\$2,048 (Model 16) / \$2,063 (Model 18)

### Conroy-LaPointe XT/Model 1" \$475

- IBM PC/XT Compatible
- 256K RAM Expandable to 640K on Motherboard
- 256K Floppy Drive
- 8 Expansion Slots
- XT Style Keyboard
- MS-DOS 2.11
- Macro Assembler
- FCC Class B/UL Approved
- Limited Warranty: 1 Year Parts & Labor

Configured and Tested Systems:

640K Systems with Mono Graphics Card & Monitor	\$480
Above 640K Systems with 20MB Hard Disk Drive	\$1,079

#### Installed Options for Models 1 and 2

- Mono Graphics Card and Monitor
 \$165 |
- |  |       |
|--|-------|
| Upgrade 256K RAM to 640K                 | \$85  |
| Second 256K Floppy Drive                 | \$85  |
| 20MB Hard Disk Drive                     | \$380 |
| 30MB Hard Disk Drive                     | \$415 |
| Serial/Parallel/Clock/Timer Port Upgrade | \$85  |
| EGA Card and NEC Multisync Monitor       | \$85  |

8 MHz/  
Zero Watt State!  
XT/Model 2+ Turbo



10.0/8.0 MHz!  
AT/Model 18 Turbo

#### Installed Options for Models 16 and 18

- Mono Graphics Card and Monitor
 \$165 |
- |                                    |       |
|------------------------------------|-------|
| Upgrade 512K RAM to 1.0MB          | \$85  |
| 30MB Hard Disk Drive               | \$645 |
| EGA Card and NEC Multisync Monitor | \$85  |

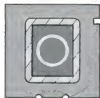
## BEST SELLER LIST

Please call if you don't see what you're looking for!

BOARDS		List	Conroy
MACROSIN Evermore II 286K RAM/MS-DOS 3.11		\$175	\$160
PC MasterCard 275K, 4.0/3.3 MHz		\$195	\$185
PC MasterCard 286K, 4.0/3.3 MHz		\$250	\$235
PC MasterCard 1386K, 4.0/3.3 MHz		\$495	\$480
ATX SuperFlo 286K, 4.0/3.3 MHz		\$245	\$235
SuperFlo Plus 286K, 4.0/3.3 MHz		\$365	\$325
SuperFlo Plus 386K, 4.0/3.3 MHz		\$495	\$455
SuperFlo Plus 486K, 4.0/3.3 MHz		\$695	\$655
SuperFlo Plus 586K, 4.0/3.3 MHz		\$895	\$855
SuperFlo Plus 686K, 4.0/3.3 MHz		\$1,095	\$1,055
SuperFlo Plus 786K, 4.0/3.3 MHz		\$1,295	\$1,255
SuperFlo Plus 886K, 4.0/3.3 MHz		\$1,495	\$1,455
SuperFlo Plus 986K, 4.0/3.3 MHz		\$1,695	\$1,655
SuperFlo Plus 1086K, 4.0/3.3 MHz		\$1,895	\$1,855
SuperFlo Plus 1186K, 4.0/3.3 MHz		\$2,095	\$2,055
SuperFlo Plus 1286K, 4.0/3.3 MHz		\$2,295	\$2,255
SuperFlo Plus 1386K, 4.0/3.3 MHz		\$2,495	\$2,455
SuperFlo Plus 1486K, 4.0/3.3 MHz		\$2,695	\$2,655
SuperFlo Plus 1586K, 4.0/3.3 MHz		\$2,895	\$2,855
SuperFlo Plus 1686K, 4.0/3.3 MHz		\$3,095	\$3,055
SuperFlo Plus 1786K, 4.0/3.3 MHz		\$3,295	\$3,255
SuperFlo Plus 1886K, 4.0/3.3 MHz		\$3,495	\$3,455
SuperFlo Plus 1986K, 4.0/3.3 MHz		\$3,695	\$3,655
SuperFlo Plus 2086K, 4.0/3.3 MHz		\$3,895	\$3,855
SuperFlo Plus 2186K, 4.0/3.3 MHz		\$4,095	\$4,055
SuperFlo Plus 2286K, 4.0/3.3 MHz		\$4,295	\$4,255
SuperFlo Plus 2386K, 4.0/3.3 MHz		\$4,495	\$4,455
SuperFlo Plus 2486K, 4.0/3.3 MHz		\$4,695	\$4,655
SuperFlo Plus 2586K, 4.0/3.3 MHz		\$4,895	\$4,855
SuperFlo Plus 2686K, 4.0/3.3 MHz		\$5,095	\$5,055
SuperFlo Plus 2786K, 4.0/3.3 MHz		\$5,295	\$5,255
SuperFlo Plus 2886K, 4.0/3.3 MHz		\$5,495	\$5,455
SuperFlo Plus 2986K, 4.0/3.3 MHz		\$5,695	\$5,655
SuperFlo Plus 3086K, 4.0/3.3 MHz		\$5,895	\$5,855
SuperFlo Plus 3186K, 4.0/3.3 MHz		\$6,095	\$6,055
SuperFlo Plus 3286K, 4.0/3.3 MHz		\$6,295	\$6,255
SuperFlo Plus 3386K, 4.0/3.3 MHz		\$6,495	\$6,455
SuperFlo Plus 3486K, 4.0/3.3 MHz		\$6,695	\$6,655
SuperFlo Plus 3586K, 4.0/3.3 MHz		\$6,895	\$6,855
SuperFlo Plus 3686K, 4.0/3.3 MHz		\$7,095	\$7,055
SuperFlo Plus 3786K, 4.0/3.3 MHz		\$7,295	\$7,255
SuperFlo Plus 3886K, 4.0/3.3 MHz		\$7,495	\$7,455
SuperFlo Plus 3986K, 4.0/3.3 MHz		\$7,695	\$7,655
SuperFlo Plus 4086K, 4.0/3.3 MHz		\$7,895	\$7,855
SuperFlo Plus 4186K, 4.0/3.3 MHz		\$8,095	\$8,055
SuperFlo Plus 4286K, 4.0/3.3 MHz		\$8,295	\$8,255
SuperFlo Plus 4386K, 4.0/3.3 MHz		\$8,495	\$8,455
SuperFlo Plus 4486K, 4.0/3.3 MHz		\$8,695	\$8,655
SuperFlo Plus 4586K, 4.0/3.3 MHz		\$8,895	\$8,855
SuperFlo Plus 4686K, 4.0/3.3 MHz		\$9,095	\$9,055
SuperFlo Plus 4786K, 4.0/3.3 MHz		\$9,295	\$9,255
SuperFlo Plus 4886K, 4.0/3.3 MHz		\$9,495	\$9,455
SuperFlo Plus 4986K, 4.0/3.3 MHz		\$9,695	\$9,655
SuperFlo Plus 5086K, 4.0/3.3 MHz		\$9,895	\$9,855
SuperFlo Plus 5186K, 4.0/3.3 MHz		\$10,095	\$10,055
SuperFlo Plus 5286K, 4.0/3.3 MHz		\$10,295	\$10,255
SuperFlo Plus 5386K, 4.0/3.3 MHz		\$10,495	\$10,455
SuperFlo Plus 5486K, 4.0/3.3 MHz		\$10,695	\$10,655
SuperFlo Plus 5586K, 4.0/3.3 MHz		\$10,895	\$10,855
SuperFlo Plus 5686K, 4.0/3.3 MHz		\$11,095	\$11,055
SuperFlo Plus 5786K, 4.0/3.3 MHz		\$11,295	\$11,255
SuperFlo Plus 5886K, 4.0/3.3 MHz		\$11,495	\$11,455
SuperFlo Plus 5986K, 4.0/3.3 MHz		\$11,695	\$11,655
SuperFlo Plus 6086K, 4.0/3.3 MHz		\$11,895	\$11,855
SuperFlo Plus 6186K, 4.0/3.3 MHz		\$12,095	\$12,055
SuperFlo Plus 6286K, 4.0/3.3 MHz		\$12,295	\$12,255
SuperFlo Plus 6386K, 4.0/3.3 MHz		\$12,495	\$12,455
SuperFlo Plus 6486K, 4.0/3.3 MHz		\$12,695	\$12,655
SuperFlo Plus 6586K, 4.0/3.3 MHz		\$12,895	\$12,855
SuperFlo Plus 6686K, 4.0/3.3 MHz		\$13,095	\$13,055
SuperFlo Plus 6786K, 4.0/3.3 MHz		\$13,295	\$13,255
SuperFlo Plus 6886K, 4.0/3.3 MHz		\$13,495	\$13,455
SuperFlo Plus 6986K, 4.0/3.3 MHz		\$13,695	\$13,655
SuperFlo Plus 7086K, 4.0/3.3 MHz		\$13,895	\$13,855
SuperFlo Plus 7186K, 4.0/3.3 MHz		\$14,095	\$14,055
SuperFlo Plus 7286K, 4.0/3.3 MHz		\$14,295	\$14,255
SuperFlo Plus 7386K, 4.0/3.3 MHz		\$14,495	\$14,455
SuperFlo Plus 7486K, 4.0/3.3 MHz		\$14,695	\$14,655
SuperFlo Plus 7586K, 4.0/3.3 MHz		\$14,895	\$14,855
SuperFlo Plus 7686K, 4.0/3.3 MHz		\$15,095	\$15,055
SuperFlo Plus 7786K, 4.0/3.3 MHz		\$15,295	\$15,255
SuperFlo Plus 7886K, 4.0/3.3 MHz		\$15,495	\$15,455
SuperFlo Plus 7986K, 4.0/3.3 MHz		\$15,695	\$15,655
SuperFlo Plus 8086K, 4.0/3.3 MHz		\$15,895	\$15,855
SuperFlo Plus 8186K, 4.0/3.3 MHz		\$16,095	\$16,055
SuperFlo Plus 8286K, 4.0/3.3 MHz		\$16,295	\$16,255
SuperFlo Plus 8386K, 4.0/3.3 MHz		\$16,495	\$16,455
SuperFlo Plus 8486K, 4.0/3.3 MHz		\$16,695	\$16,655
SuperFlo Plus 8586K, 4.0/3.3 MHz		\$16,895	\$16,855
SuperFlo Plus 8686K, 4.0/3.3 MHz		\$17,095	\$17,055
SuperFlo Plus 8786K, 4.0/3.3 MHz		\$17,295	\$17,255
SuperFlo Plus 8886K, 4.0/3.3 MHz		\$17,495	\$17,455
SuperFlo Plus 8986K, 4.0/3.3 MHz		\$17,695	\$17,655
SuperFlo Plus 9086K, 4.0/3.3 MHz		\$17,895	\$17,855
SuperFlo Plus 9186K, 4.0/3.3 MHz		\$18,095	\$18,055
SuperFlo Plus 9286K, 4.0/3.3 MHz		\$18,295	\$18,255
SuperFlo Plus 9386K, 4.0/3.3 MHz		\$18,495	\$18,455
SuperFlo Plus 9486K, 4.0/3.3 MHz		\$18,695	\$18,655
SuperFlo Plus 9586K, 4.0/3.3 MHz		\$18,895	\$18,855
SuperFlo Plus 9686K, 4.0/3.3 MHz		\$19,095	\$19,055
SuperFlo Plus 9786K, 4.0/3.3 MHz		\$19,295	\$19,255
SuperFlo Plus 9886K, 4.0/3.3 MHz		\$19,495	\$19,455
SuperFlo Plus 9986K, 4.0/3.3 MHz		\$19,695	\$19,655
SuperFlo Plus 10086K, 4.0/3.3 MHz		\$19,895	\$19,855
SuperFlo Plus 10186K, 4.0/3.3 MHz		\$20,095	\$20,055
SuperFlo Plus 10286K, 4.0/3.3 MHz		\$20,295	\$20,255
SuperFlo Plus 10386K, 4.0/3.3 MHz		\$20,495	\$20,455
SuperFlo Plus 10486K, 4.0/3.3 MHz		\$20,695	\$20,655
SuperFlo Plus 10586K, 4.0/3.3 MHz		\$20,895	\$20,855
SuperFlo Plus 10686K, 4.0/3.3 MHz		\$21,095	\$21,055
SuperFlo Plus 10786K, 4.0/3.3 MHz		\$21,295	\$21,255
SuperFlo Plus 10886K, 4.0/3.3 MHz		\$21,495	\$21,455
SuperFlo Plus 10986K, 4.0/3.3 MHz		\$21,695	\$21,655
SuperFlo Plus 11086K, 4.0/3.3 MHz		\$21,895	\$21,855
SuperFlo Plus 11186K, 4.0/3.3 MHz		\$22,095	\$22,055
SuperFlo Plus 11286K, 4.0/3.3 MHz		\$22,295	\$22,255
SuperFlo Plus 11386K, 4.0/3.3 MHz		\$22,495	\$22,455
SuperFlo Plus 11486K, 4.0/3.3 MHz		\$22,695	\$22,655
SuperFlo Plus 11586K, 4.0/3.3 MHz		\$22,895	\$22,855
SuperFlo Plus 11686K, 4.0/3.3 MHz		\$23,095	\$23,055
SuperFlo Plus 11786K, 4.0/3.3 MHz		\$23,295	\$23,255
SuperFlo Plus 11886K, 4.0/3.3 MHz		\$23,495	\$23,455
SuperFlo Plus 11986K, 4.0/3.3 MHz		\$23,695	\$23,655
SuperFlo Plus 12086K, 4.0/3.3 MHz		\$23,895	\$23,855
SuperFlo Plus 12186K, 4.0/3.3 MHz		\$24,095	\$24,055
SuperFlo Plus 12286K, 4.0/3.3 MHz		\$24,295	\$24,255
SuperFlo Plus 12386K, 4.0/3.3 MHz		\$24,495	\$24,455
SuperFlo Plus 12486K, 4.0/3.3 MHz		\$24,695	\$24,655
SuperFlo Plus 12586K, 4.0/3.3 MHz		\$24,895	\$24,855
SuperFlo Plus 12686K, 4.0/3.3 MHz		\$25,095	\$25,055
SuperFlo Plus 12786K, 4.0/3.3 MHz		\$25,295	\$25,255
SuperFlo Plus 12886K, 4.0/3.3 MHz		\$25,495	\$25,455
SuperFlo Plus 12986K, 4.0/3.3 MHz		\$25,695	\$25,655
SuperFlo Plus 13086K, 4.0/3.3 MHz		\$25,895	\$25,855
SuperFlo Plus 13186K, 4.0/3.3 MHz		\$26,095	\$26,055
SuperFlo Plus 13286K, 4.0/3.3 MHz		\$26,295	\$26,255
SuperFlo Plus 13386K, 4.0/3.3 MHz		\$26,495	\$26,455
SuperFlo Plus 13486K, 4.0/3.3 MHz		\$26,695	\$26,655
SuperFlo Plus 13586K, 4.0/3.3 MHz		\$26,895	\$26,855
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SuperFlo Plus 13886K, 4.0/3.3 MHz		\$27,495	\$27,455
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SuperFlo Plus 14086K, 4.0/3.3 MHz		\$27,895	\$27,855
SuperFlo Plus 14186K, 4.0/3.3 MHz		\$28,095	\$28,055
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SuperFlo Plus 14886K, 4.0/3.3 MHz		\$29,495	\$29,455
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SuperFlo Plus 15486K, 4.0/3.3 MHz		\$30,695	\$30,655
SuperFlo Plus 15586K, 4.0/3.3 MHz		\$30,895	\$30,855
SuperFlo Plus 15686K, 4.0/3.3 MHz		\$31,095	\$31,055
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SuperFlo Plus 16086K, 4.0/3.3 MHz		\$31,895	\$31,855
SuperFlo Plus 16186K, 4.0/3.3 MHz		\$32,095	\$32,055
SuperFlo Plus 16286K, 4.0/3.3 MHz		\$32,295	\$32,255
SuperFlo Plus 16386K, 4.0/3.3 MHz		\$32,495	\$32,455
SuperFlo Plus 16486K, 4.0/3.3 MHz		\$32,695	\$32,655
SuperFlo Plus 16586K, 4.0/3.3 MHz		\$32,895	\$32,855
SuperFlo Plus 16686K, 4.0/3.3 MHz		\$33,095	\$33,055
SuperFlo Plus 16786K, 4.0/3.3 MHz		\$33,295	\$33,255
SuperFlo Plus 16886K, 4.0/3.3 MHz		\$33,495	\$33,455
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SuperFlo Plus 17086K, 4.0/3.3 MHz		\$33,895	\$33,855
SuperFlo Plus 17186K, 4.0/3.3 MHz		\$34,095	\$34,055
SuperFlo Plus 17286K, 4.0/3.3 MHz		\$34,295	\$34,255
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SuperFlo Plus 17486K, 4.0/3.3 MHz		\$34,695	\$34,655
SuperFlo Plus 17586K, 4.0/3.3 MHz		\$34,895	\$34,855
SuperFlo Plus 17686K, 4.0/3.3 MHz		\$35,095	\$35,055
SuperFlo Plus 17786K, 4.0/3.3 MHz		\$35,295	\$35,255
SuperFlo Plus 17886K, 4.0/3.3 MHz		\$35,495	\$35,455
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SuperFlo Plus 18086K, 4.0/3.3 MHz		\$35,895	\$35,855
SuperFlo Plus 18186K, 4.0/3.3 MHz		\$36,095	\$36,055
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SuperFlo Plus 18686K, 4.0/3.3 MHz		\$37,095	\$37,055
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SuperFlo Plus 19486K, 4.0/3.3 MHz		\$38,695	\$38,655
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SuperFlo Plus 19686K, 4.0/3.3 MHz		\$39,095	\$39,055
SuperFlo Plus 19786K, 4.0/3.3 MHz		\$39,295	\$39,255
SuperFlo Plus 19886K, 4.0/3.3 MHz		\$39,495	\$39,455
SuperFlo Plus 19986K, 4.0/3.3 MHz		\$39,695	\$39,655
SuperFlo Plus 20086K, 4.0/3.3 MHz		\$39,895	\$39,855
SuperFlo Plus 20186K, 4.0/3.3 MHz		\$40,095	\$40,055
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SuperFlo Plus 20386K, 4.0/3.3 MHz		\$40,495	\$40,455
SuperFlo Plus 20486K, 4.0/3.3 MHz		\$40,695	\$40,655
SuperFlo Plus 20586K, 4.0/3.3 MHz		\$40,895	\$40,855
SuperFlo Plus 20686K, 4.0/3.3 MHz		\$41,095	\$41,055
SuperFlo Plus 20786K, 4.0/3.3 MHz		\$41,295	\$41,255
SuperFlo Plus 20886K, 4.0/3.3 MHz		\$41,495	\$41,455
SuperFlo Plus 20986K, 4.0/3.3 MHz		\$41,695	\$41,655
SuperFlo Plus 21086K, 4.0/3.3 MHz		\$41,895	\$41,855
SuperFlo Plus 21186K, 4.0/3.3 MHz		\$42,095	\$42,055
SuperFlo Plus 21286K, 4.0/3.3 MHz		\$42,295	\$42,255
SuperFlo Plus 21386K, 4.0/3.3 MHz		\$42,495	\$42,455
SuperFlo Plus 21486K, 4.0/3.3 MHz		\$42,695	\$42,655
SuperFlo Plus 21586K, 4.0/3.3 MHz		\$42,895	\$42,855
SuperFlo Plus 21686K, 4.0/3.3 MHz		\$43,095	\$43,055
SuperFlo Plus 21786K, 4.0/3.3 MHz		\$43,295	\$43,255
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## ■ GUS VENDITTO

## PC ADVISOR



*Help in deciding whether to buy a combination laser printer/copier; in running 1-2-3 on a Data General/One; in quieting an AT; and in getting started with a PC.*

**LASER PRINTER/COPIER COMBO**

Since laser printing technology is similar to that used in a copying machine, it makes sense to put both in the same product. Has anyone made one?

E. J. Isley  
Metuchen, New Jersey

*It wouldn't take too many guesses to pick the company that did it, but you'll have to decide whether it really makes sense. The Xerox 4045 Laser CP printer, Model 50, is a 120-pound behemoth that can produce high-quality 300 dot-per-inch pages at the rate of nine per minute. Because it's compatible only with Diablo 6300 and Xerox 2700 print codes, it's fairly limited if you use a variety of software; Xerox offers its own downloadable software fonts, and a generous 1.5 megabytes of RAM to load them into. At \$4,995 for the printer, plus \$400 for the copier option, you may find it makes more sense to buy a QMS, Okidata, or Hewlett-Packard laser printer for under \$2,500, and a separate copier for a lot less than that. (Xerox Corp., El Segundo, Calif. (800) 334-6200)*

**1-2-3 ON A DG/ONE**

I use my Data General/One with PC-Write and Lotus's 1-2-3, Release 1A. My problem is that I want to use 1-2-3, Release 2.01, but I cannot get Lotus to release a "certified" version to run on the DG/One. I have called Lotus to ask this question, but all it can say is to upgrade and see what happens.

Steven I. Feinstein  
San Antonio, Texas

*Both Data General and Lotus assure me that 1-2-3, Release 2.01, on 3½-inch disks has been tested and is compatible with the DG/One.*

**TOWARD A QUIETER AT**

I have an AT clone from PC Designs that is terrific in every respect save one: its cooling fan roars. Your magazine and others advertise many replacement power supplies for PCs and XT's, but I have yet to see an ad for an AT-class supply.

Stephen M. Schuetz  
New York, New York

*Few people ever see a need to replace their AT power supply. A quieter work environment, however, is an excellent reason to switch the power supply—by far the noisiest part of your PC. The Silencer AT 200 (PC Cooling Systems, Bonsall, Calif.: (619) 723-9513; \$149) will make your office more pleasant as soon as it's installed.*

■ Few people ever see a need to replace their AT power supply. A quieter work environment, however, is an excellent reason to switch.

**PATH FOR A BEGINNER**

My brother-in-law recently gave me an IBM PC-XT clone. When he gave it to me, his words were "play with it." Even though I have a master's degree, I find myself completely lost deciphering the 16½ million bytes' worth of files on the hard drive. Could you please recommend a "path" whereby I can get off the beach and into the water.

Robert G. Hammer  
Lake Ronkonkoma, New York

*Go to the nearest software store and get yourself a copy of both Learning DOS (Microsoft Corp., Redmond, Wash.: (206) 882-8080; \$49.95) and First Choice (Seftware Publishing Corp.; Mountain View, Calif.: (415) 962-8910; \$199).*

*Do not read the manuals. Open Learning DOS first, but do not use the Learning DOS demonstration disk (it's only an advertisement for Microsoft). Turn on the PC; when it's running and the prompt reads C:, put Learning DOS's "Lessons for Computers with a Hard Disk" disk in the top (or left) disk drive; type "A:."; then type "LEARN"; skip the first two selections and go right to Getting Started. When you're done, start being productive with First Choice. If all else fails, you'll have to read the manuals.*

*Within a few months, you'll be ready to start writing your own programs.*

**ASK THE ADVISOR**

Send your questions to the PC Advisor, PC Magazine, One Park Avenue, New York, NY 10016.

The most important bookkeeping tool on this desk...



...is the telephone.

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### The Software

**The Purchaser:** a company, large or small (or even an individual) looking for a flexible, powerful, easy to use bookkeeping program; or a company presently doing its own computerized bookkeeping, but needing better software, better support, or both.

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**The Plan:** listening to our customers, and continuing to provide them with the most complete, best organized, and easiest to use program possible.

**The Prerequisites:** owning an IBM-PC (or the equivalent) having two disk drives, 256K of memory, and DOS 2.0 (or later).

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**The Promise:** buy the program and use it for a month (enter up to three months of real data); if not satisfied, return it for a full refund of the purchase price.

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**The Particulars:** prepaying a fee for a fixed amount of service time; calling in on toll-free lines, careful timing of every call; charging only for actual time spent listening and giving answers, using a modem, so we can watch on our screen (and advise), while you work on your books.

**The Power:** enough highly trained, dedicated support personnel (all with formal accounting education), together with more than enough toll-free phone lines, to answer all questions and solve all problems quickly and efficiently.

**The Past:** installing and supporting bookkeeping systems for many years (and acquiring thereby a thorough and abiding understanding of the needs of the business manager).

**The Plan:** providing responsive, efficient, and inexpensive assistance in both bookkeeping and computer use.

**The Prerequisites:** owning a registered copy of *The Company Books*.

**The Price:** \$175 for the first two and one half hours; \$75 for each additional sixty minutes.

**The Promise:** buy the service and use it for a month; if not satisfied, cancel it, and we'll refund one dollar for each unused minute.



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CIRCLE 278 ON READER SERVICE CARD

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Next came their racy 287 FAST/5, a math coprocessor module with its own 5MHz clock, speeding up PC/AT math by 25%. (Pictured above.)

Now, Hauppauge Unveils the 287 FAST/10... Our newest math coprocessor for the PC/AT, the 287 FAST/10 moves out at 10MHz—more than doubling the speed of each floating point math operation. The FAST/10 accelerates AutoCad, 1-2-3, Symphony, Turbo Pascal, Framework and more. The FAST/10 also runs in PC/AT compatibles including the Compaq Deskpro 286, Sperry PC/IT and most 286 accelerator boards.

...And the 87 Software Pak Version 6.0 Designed to steal the heart of programmers, the 87 Software Pak supports IBM's BASIC Compiler 1.0 and 2.0, and Microsoft's QuickBASIC, executing math-intensive programs up to 20 times faster! The 87 Software Pak also performs FFT's and Matrix operations. For example, a PC (or PC/XT) with an 87 Chip and 87 Software Pak can perform a 512-point complex FFT in just 1.1 seconds. What's more, a PC/AT with a FAST/10 inverts a 25 by 25 element matrix in under 1 second.

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# FIRST LOOKS

## The Compaq Portable III: 20 Pounds of AT Power

### PC HANDS ON

BY BILL MACHRONE

In some ways there's nothing new about the Compaq Portable III. In other ways, there's never been anything like it before. You've seen all the design elements elsewhere: lunchbox configuration, hard disk, and gas plasma display. But they've never been combined with such sterling performance.

The Portable III is an 80286-based machine that runs at 12 MHz, packs a 1.2-megabyte floppy disk drive, and has the fastest hard disk we've yet seen in a portable. At 20 pounds it's not light, and it doesn't run on batteries. Compaq feels strong-

*The screen pops up from the Compaq Portable III's trim box; the keyboard attaches to the front of the display to the Portable II.*

ly that its customers do their computing within reach of an electrical outlet. The company also emphasizes that it's a 5¼-inch world out there and that 3½-inch disks are an inconvenience at best.

The raw performance of this machine will bring many a potential Toshiba 3100 customer back into the fold. Even though it outweighs the 3100 by a few pounds, the Portable III doesn't take a back seat to anything else on the market, port-



ble or not, except its 80386 big brother.

The plasma display is mounted on a pair of articulated arms that swing it up and allow

you to tilt it to any of several comfortable viewing angles. The keyboard is equivalent to that of other Compags, with tactile but inaudible over-center action. The ten function keys are arrayed across the top, as they were on the Portable II.

Inside, the Portable III is tightly packed, but there is room enough for two Compaq-proprietary expansion boards. One holds up to 6.6 megabytes of memory. The other is a Hayes-compatible 300/1,200-bit-per-second modem. Given the serial, parallel, and CRT ports on the back, most needs are covered. But you're not out of luck if you need more. An optional expansion module piggybacks

*(continues on page 34)*

## HP Laserjet Series II: Lower Price, Far Better Performance

### PC HANDS ON

BY BILL MACHRONE

Hewlett-Packard Co.'s Laserjet Series II knows where it's from. It's improved over the Laserjet Plus in every key area except speed, which remains the same. It has blacker blacks, better image definition, in-order stacking, two cartridge slots, 200-sheet paper capacity, more resident fonts, and better forms handling, and it's smaller, lighter, and quieter. It's dramatically less expensive at \$2,495.

The Series II is a direct re-

placement for the Laserjet Plus. It sports the same 512K-byte memory and command set, yet it offers more expansion for the future. Simple plug-in boards take the memory all the way up to 4.5 megabytes for virtually unlimited downloadable fonts and complex graphic images. An expansion slot for I/O options takes either a board that adapts the Series II for use with HP's forthcoming DDL page description language board or a board that shares the printer among three PCs.

Like the Laserjet Plus, the new printer has a serial and par-

allel interface. With its new front panel, it is much easier to use. While most of the new inexpensive laser printers are satisfied to have a 1- or 2-character status display, the HP has a 16-character display that explains each menu option clearly.

You can completely configure the printer from the front panel, without knowing its intricate escape codes. That includes selecting any of the internal fonts, either font cartridge, or downloaded soft fonts. The Print Fonts key on the front panel dumps the currently resident

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### HANDS-ON INDEX

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## Portable III

(continued from page 33)

onto the rear of the computer, giving you two full-size AT-compatible expansion slots. It will handle the gamut of add-on boards, including local-area network adapters. It snaps on and off easily, with a positive locking scheme to make sure it doesn't come adrift.

In operation the Portable III is quiet and quick. It passed PC Labs benchmark tests with flying colors, consistently logging performance 1½ times faster than an 8-MHz PC AT. As with the Deskpro 386, programs that start from the A: drive invoke an automatic slowdown mode so as to minimize problems with copy-protected disks. If you want programs to run at full speed, you must start them from the hard disk. And the hard disk is the fastest yet seen in a portable. The 20-megabyte drive in our test unit clocked in at just a 27-millisecond average access time, compared with its rated 30 milliseconds.

### Crisp Display

The display is needle-sharp and seems to have overcome the limitations of some other plasma displays in converting colors to brightness levels. In Compaq tradition, the display driver emulates both the Color Graphics Adapter and the Monochrome Display Adapter. The 10-inch display is large enough to share.

Others won't have to squint to see your work on the screen.

The portable computer market has fragmented into half a dozen niches. There is still room for the AT-with-a-handle, just as there is still room for the non-DOS notebook computer. The DOS laptop market is battery powered and is amazingly healthy. The Portable III defines the DOS lunchbox computer market and challenges the others on their own turf.

## PC FACT FILE

**Compaq Portable III**  
Compaq Computer Corp.  
20555 FM 149  
Houston, TX 77070  
(713) 370-0670

**List Price:** Model 1, with two high-density floppy disk drives, \$3,999; Model 20 with 20-Mbyte hard disk and one high-density floppy disk drive, \$4,999; Model 40 with a 40-Mbyte hard disk and one high-density floppy disk drive, \$5,999.

**In Short:** The new champ among movable PCs in performance, the Portable III loses points only for its awkward shape. It's lighter than the Portable II, but more bulky than Toshiba's sleek T3100.

CIRCLE 441 ON READER SERVICE CARD

## Toshiba's Laptop Gets a Supertwist LCD Screen

### PC HANDS ON

BY BILL HOWARD

Portable computer makers leapfrog the competition with regularity. The latest move comes from Toshiba America, the company that legitimized the

to \$2,099, for its 640K-byte RAM version and discontinued the \$1,999 256K model.

The screen can be retrofitted to the two-drive T1100 Pluses but not the original one-drive T1100. Toshiba expects the price will be in line with the \$250 IBM gets to upgrade the PC Portable screen.

How does Toshiba stack up to the competition? Based on a configuration with a supertwist LCD screen, 640K bytes of RAM, and two 3½-inch 720K-byte disk drives, the Toshiba remains the smallest, lightest, and second fastest of the major contenders. The \$2,399 Zenith Z-181 has the easiest to read screen, but battery life is relatively short (2 to 3 hours).

The \$1,995 NEC Multi-speed is the speed champ (with a 9.5/4.77-MHz V-30 chip to Toshiba's 7.14/4.77-MHz 80C86) and most affordable. And NEC's larger screen is slightly easier to read.

IBM's bulky PC Convertible, which now has a supertwist LCD screen, is improved but still a bridesmaid. It runs longer than any of the others (7 to 8 hours) and has the best keyboard, but properly equipped it's \$2,775.

Each machine appeals to a



The \$2,099 Toshiba T1100 Plus's new supertwist LCD screen dramatically improves readability. Current T1100 Pluses can be upgraded.

market a year and a half ago when it introduced the Toshiba T1100.

Version 3 of the T1100 adds a supertwist LCD screen for better contrast and legibility. The improvement is minor but enough to put the T1100 Plus in or tied for top place among non-illuminated displays.

At the same time, Toshiba has dropped the price by \$300,



### Benchmark Tests: Compaq Portable III vs. Compaq Portable II and Toshiba T3100

The Compaq Portable III is the one to beat in movable computing. An incompatibility in the Toshiba T3100's BIOS prevented it from running our BIOS Disk Seek test, but Toshiba rates the T3100's hard disk access at 100 milliseconds.

#### Performance Times

(Times given in seconds except where noted)

Product	MOP	8086 Instruction Mix	BIOS Disk Seek (milliseconds)
Compaq Portable II	4.20	9.10	72.38
Toshiba T3100	5.70	12.50	100.00*
Compaq Portable III	3.50	6.60	27.38

\*According to manufacturer.

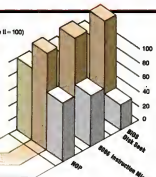
The MOP benchmark test is designed to measure raw clock speed and memory access time while minimizing differences in microprocessors and the effect of memory caching. This test executes almost nothing but MOP ("No Operation") machine code instructions in a big 1024K loop.

The 8086 Instruction Mix benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 8086 instruction code. These instructions are a subset of the total processor instruction set.

The BIOS Disk Seek benchmark test measures the time it takes to do a random seek using the disk's ROM BIOS. The test result includes minimal software overhead and may not parallel the manufacturer's claimed average access time. The test program performs 1,000 seeks. The average result is shown in milliseconds.

#### Relative Times

(Ratio: Compaq Portable II = 100)



## PC FACT FILE

**Toshiba T1100 Plus**  
Toshiba America Inc.  
Information Systems Div.  
2441 Michelle Dr.  
Tustin, CA 92680  
(714) 730-5000  
**List Price:** \$2,099 with 640K RAM, two 3½-inch floppy drives, parallel port, serial port.  
**In Short:** PC Magazine's Editor's Choice laptop adds a superwist LCD screen and gets easier to read and \$300 cheaper. It's still the most compact of the top-high DOS-on-a-handle machines.

CIRCLE 444 ON READER SERVICE CARD

slightly different user niche. Toshiba's niche is for the user who wants the best balance of features in the smallest footprint.

# Lotus Express Manages E-Mail, Binary Transfers in Background

## PC HANDS ON

BY BILL HOWARD

TV commercials for PCs often show an upscale bunch in an airy, plant-filled office. They tap the keyboard three or four times, watch the screen build a graph that rises to the right, pat each other on the back, then head out for a Michelob faster than you can say "hostile takeover."

Lotus Express may be one of few programs that make the PC as easy and hassle-free as the ads suggest. This \$100 program runs in the background while you do other chores and sends and receives files via MCI Mail, the e-mail service of choice.

Before Express came along,

MCI Mail was great for exchanging memos. Spreadsheet, database, and word processor files had to be converted to straight ASCII text, 78 characters per line maximum, and then reconverted at the other end.

Express checks your MCI Mail box several times a day, downloads waiting messages, and uploads your messages to others. If it can't get through or your PC crashes, Express tries again a few minutes later. Every message for you and from you is stored as a separate file on disk. That's different than with other communications programs, in which a capture stream involving several messages is one long file on disk.

Express uses folders, or disk subdirectories, for incoming,

outgoing, draft, sent, and unsent messages, and you can make your own additional folders, if desired. You can write messages with Express's rudimentary text editor or pull them in from your favorite word processor.

Express is well behaved for a terminate-and-stay-resident (TSR) program, but if you don't want to give up the approximately 200K bytes of memory Express appropriates to run in the background, you can run Express all by itself as a standard application.

Shortcomings? A few: Once your in-box builds to several hundred messages, you will wish Express had a masking function that would display only

(continues on page 36)

## Laserjet

(continued from page 33)

fonts and their codes in a printed worksheet format. The worksheets make it a cinch to configure the printer manually or select the codes you want for printer drivers.

The new Canon engine on which the Series II is based reduces warm-up time from 2 minutes to a mere 30 seconds. It also makes use of a new toner technology that results in denser images, more adjustability, and far less ozone smell while the printer is in operation. The cartridge life is extended from 3,000 to 4,000 pages. After more than 1,000 pages, our test unit is still producing dense, black images, with no streaks or fuzzy edges. The toner cartridge has been in and out a number of times, and it does not drop toner or make the mess that some other printers do.

The Laserjet Series II cranks out 7.5 pages per minute over 20 pages on PC Labs benchmark tests, compared with its rated performance of 8 pages per minute, the same as its predecessor. As easy as maintenance

was on the old engine, it's even better on the new one. The paper path is short and direct, with an option for bypassing the face-down output tray for thick forms or envelopes. Handling of odd-size forms and envelopes is dramatically better in the new machine. Adjustable guides are built into the top of the paper tray. Regular paper and special forms go in top first, right side up. Conceptually, this is the easiest arrangement for people to deal with.

One small strangeness is that the input tray holds 200 sheets, while the output tray holds only 100 sheets. Unattended operation

is feasible, if you keep the 100-sheet limit in mind, since the machine is very jam-resistant. None of the current multi-bin feeders will work on this machine; they'll have to be redesigned from scratch.

The two font cartridge slots are a boon, too. They allow a set of "body" fonts and a set of headline or presentation graphics fonts to be present at the same time. None of the word processors currently on the market can access the second cartridge, but publishers will be quick to make their software compatible with this jewel. In the meantime, the more adven-

Hewlett-Packard's 50-pound Laserjet Series II has a sleeker design and offers a 16-character LCD that keeps you posted on print status and font selection.



## PC FACT FILE

**HP Laserjet Series II**  
Hewlett-Packard Co.  
1131 Chinden Blvd.  
Boise, ID 83714  
(800) 367-4772  
**List Price:** \$2,495 with 512K RAM, six fonts, EP cartridge; optional 1 Mbyte RAM, \$495; optional 2 Mbytes RAM, \$1,995.  
**Dimensions (HWD):** 8.15 x 18 x 19 in.  
**Weight:** 50 lbs.  
**In Short:** Dramatic improvement over HP's Laserjet Plus with a significantly reduced price.

CIRCLE 440 ON READER SERVICE CARD

turesome will be able to modify their printer drivers with HP's long-winded escape codes.

The Laserjet Series II is priced like the 6-ppm machines, performs better than its predecessor, and is fully compatible with all HP font cartridges, soft fonts, and support software. It can't miss.

# Measure Routes Sampling Data Into WK1 or ASCII Format

PC HANDS ON

BY WINN L. ROSCH

Scientific data acquisition usually means running experiments, writing down the results, and then typing them into a spreadsheet or other statistical tool for analysis.

Lotus Development Corp.'s *Measure* is a new alternative. Not a standalone program, *Measure* works under I-2-3, attaching itself to the spreadsheet's drivers through hooks built into I-2-3 (Release 2 and 2.01 only). Once it has been installed in I-2-3, the software system can control any of nearly 8,000 compatible test instruments, automatically sampling during an experiment, collecting the data, and then storing it in an ordinary I-2-3 spreadsheet file.

The current *Measure* package consists of four modules, each designed for a different hardware interface for acquiring data. These options include the standard RS-232C port, the IBM Game Control Adapter, the IEEE-488 interface (termed General Purpose Interface Bus by IBM), and the proprietary MetaByte DAS-16 data acquisition board. The actual features of each module differ to accommodate the requirements of the various hardware interfaces.

Before any module can be used, it must be installed in the I-2-3 driver library using either the I-2-3, Release 2, Install utility or a separate quick installation program thoughtfully included with *Measure*. To use the module, you specify the name of the driver set on the command line when you enter I-2-3. Then you simply switch between normal operation of I-2-3 and that of the new module, for instance by pressing the Alt-F8 combination.

After you enter *Measure* you are back inside your spreadsheet but now you will have an entirely new lineup of command op-

tions and other features.

Facilities are provided for setting up the details of the data acquisition for your experiments. For instance, using the module for MetaByte's DAS-16 board, you can define various aspects of each input channel for up to four MetaByte boards (a total of 64 input channels in real time) and assign a multiplier to scale the input data. You also set the sampling

A special verify option allows you to confirm that you have properly set up the system before you begin. Selecting the Go command starts data acquisition. *Measure* then takes control over both your experiment and your PC.

The obvious application for *Measure* is when you plan to analyze and graph the results of your experiments using I-2-3. But even if you choose a more

```

1 2 3 4 5 6 7 8 Clear Rate Number Trigger ( ) 200
Return to Stage-Settings menu

      Stage One      Stage Two      Stage Three
Divisor 1/2 Group  Divisor 1/2 Group  Divisor 1/2 Group
1      50 SPWCE      1 TIME      1 WARP
2      25 SPWCE      2 TIME      1 WARP
3      12 SPWCE      4 TIME      1 WARP
4       6 SPWCE      12 TIME     1 WARP
5       3 SPWCE      25 TIME     1 WARP
6       1 SPWCE      50 TIME     1 WARP
7
8

Sampling Rate: 1/Sec      60/Hz      30.00/Hz
Number of Samples: 100    100
Stage Total: 163         163

Trigger: 200/TIME      # 21:30      Keyboard

Grand Total: 526      Additional Loops: 0      Start Stage: 1
                                   End Stage: 1

10-File-97 89 55 00      6/9 Stage Settings C:\MSDOS\SYSTEM\HOF

```

*Measure* comes with utilities to support four data input formats: RS-232, IBM Game Port, IEEE-488, and MetaByte's DAS-16.

rate. And, of course, you assign where the data will be stored in your spreadsheet. The IEEE-488 module supports up to 15 devices and adds 21 new macro commands to the I-2-3 repertoire. The RS-232C module works with normal COM ports and adds seven new macro commands.

powerful statistical program, such as *SPSS/PC+*, for your analysis, getting your data into a standard format—as either a WK1 file or an ASCII (PRN) file—will be a timesaver and will help guarantee against transcription errors.

*Measure* will help you eliminate the drudgery of collecting

## Lotus Express

(continued from page 35)  
 certain message threads based on the sender or subject. The print function cannot offset from the left margin, skip perforations, or double-space, all of which would be very handy if you wanted a quick hard copy of a message. If you have several mailboxes, *Express* requires you to make a call for each box. *Express* also includes a hyperdumb terminal program with only one feature: the ability to capture to disk.

PC FACT FILE

### Lotus Express

Lotus Development Corp.  
 55 Cambridge Pkwy.  
 Cambridge, MA 02142  
 (617) 577-8500

List Price: \$100, including 1-year subscription to MCI Mail; message charge of about \$1 per 7,500 characters.  
 Requires: 256K RAM (320K with DOS 3.0 or later), Hayes-

PC FACT FILE

### Measure

Lotus Development Corp.  
 55 Cambridge Pkwy.  
 Cambridge, MA 02142  
 (617) 577-8500

List Price: \$495

Requires: 512K RAM; I-2-3, Version 2; DOS 2.0 or later.

In Short: A set of four I-2-3 drivers that acts as control software for computer-interfaced instruments and automatically samples, scales, and loads data into I-2-3 spreadsheets.

CIRCLE 448 ON READER SERVICE CARD

### DAS-16

MetaByte Corp.  
 440 Myles Standish Blvd.  
 Trumton, MA 02780  
 (617) 344-1990

List Price: \$945

Requires: One 8-bit expansion slot.

In Short: Acquires up to 64 channels of data simultaneously, with the ability to display up to 16 in real time; converts analog input into digital engineering units. Has maximum sampling rate of 50,000 samples per second, far higher than *Measure*'s maximum of 3,000 samples per second.

CIRCLE 449 ON READER SERVICE CARD

data and implementing an automatic data acquisition system, leaving you with more time for the more-creative parts of your work, experiment design, and data analysis.

compatible modem. Hard disk recommended.

In Short: Hassle-free RAM-resident program to transfer error-free messages and files (including binary files) over MCI Mail. It runs in the background and requires no special knowledge of communications or modems. Not copy protected.

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**Validation Types:** Range, List, File, and any formula allowed in dBASE

**Computations:** Anything allowed in dBASE; performed on screen as you enter or change data.

**Supplied Programs:** General purpose LOOKUP and UPDATE programs included as dBASE source code. Use them in any application.

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PC Magazine

"Quickreport from Fox & Geller is a top-notch report generator that's easy to learn and operate... a furlong ahead of dBASE."  
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# Amstrad Imports a Series of Speedy, Innovative PCs to U.S.

## PC HANDS ON

BY STEPHEN RANDY DAVIS

The largest computer manufacturer in Britain, Amstrad, is testing U.S. waters with one of the hottest-selling personal computers in Europe, the Amstrad PC1512.

The PC1512 is a low-price, Korean-built IBM PC clone with 512K bytes of memory and an 8-MHz 8086 microprocessor, which runs roughly twice as fast as a stock 4.77-MHz PC on PC Labs benchmark tests. The PC1512 comes in several configurations ranging in list price from \$799 for the single floppy disk drive, monochrome model to \$1,499 for the 20-megabyte hard disk, color monitor model.

All configurations include a clock/calendar, Microsoft Mouse-compatible mouse, and swivel monitor pedestal. In addition to MS-DOS 3.2, Amstrad bundles the GEM user shell, *GEM Paint*, something called *Locomotive BASIC 2*, and *DOS Plus* (Digital Research's DOS-compatible CP/M-86) with the PC1512.

The PC1512's footprint is roughly half as large as that of

its IBM-made cousin partly because of its placement of the power supply in the monitor. As a result, the PC1512 has no fan and runs completely quiet.

But you can use only an Amstrad-made monitor. There is no possibility of connecting an EGA, Hercules, or any other



A compact machine, the Amstrad PC1512 footprint takes up about half the space of an IBM PC.

adapter. The 13-inch monitor on my review unit generated acceptably bright colors in CGA resolution.

My one complaint was that any time dark horizontal graphic images appeared on light backgrounds, they were notice-

ably shifted over to the left.

The PC1512 has built-in connectors for one serial port, one parallel port, keyboard, mouse, and joystick, all clearly marked and accessible. The base unit includes a speaker volume control. Four penlight batteries, which are in a compartment on the top of the unit, power the clock/calendar.

The keyboard was somewhat mushy. Key placement was more or less stock except for an enlarged Return and the placement of the Alt key next to the Shift key.

The Amstrad's three IBM-compatible slots were accessible without even a screwdriver by simply sliding a cover off the back of the unit. Three slots may not seem like a lot, but with so much already included on the motherboard you shouldn't need to add much. However, heat buildup could become a problem since there's no fan to vent the card cage.

The manual is very compact, including instructions for three operating environments, one language, and one application in its 200-odd pages.

The PC1512 is a very well-thought-out machine. Amstrad may have some distribution

## PC FACT FILE

### Amstrad PC1512

Amstrad International USA Inc.

3202 Doolittle Dr.  
Northbrook, IL 60062  
(312) 498-6340

**List Price:** Model DDM with two disk drives and monochrome monitor with adapter, \$899. Model SDC with one disk drive and color monitor with adapter, \$999. Model DDC with two disk drives and color monitor with adapter, \$1,099. Model HDM with floppy disk drive, 20-Mbyte hard disk drive, and monochrome monitor with adapter, \$1,299. Model HDC with floppy disk drive, 20-Mbyte hard disk drive, and color monitor with adapter, \$1,499.

**In Short:** An unconventional but promising PC compatible that packs an impressive assortment of features at an alluring price.

CIRCLE 438 ON READER SERVICE CARD

problems yet to work out as it gets a foothold in this country, but once it does, the PC1512 represents a price and performance level that will be hard to beat.



## Benchmark Tests: Amstrad PC1512 vs. IBM PC-XT and Tandy 1000SX

Amstrad's low-cost machine delivers plenty of speed. Running at a clock rate of 8 MHz, it should beat the 4.77-MHz IBM PC-XT and the 7.16-MHz Tandy 1000SX, but the degree to which it surpassed their times indicates good engineering.

### Performance Times

(Times given in seconds except where noted)

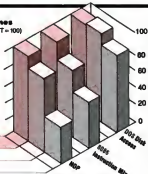
Product	NOP	8086 Instruction Mix	DOS Disk Access (milliseconds)
IBM PC-XT	10.14	32.02	234.70
Tandy 1000SX	8.90	25.32	242.50
Amstrad PC1512	4.51	17.47	211.42

The **NOP** benchmark test is designed to measure raw clock speed and memory access time while minimizing differences in microprocessors and the effect of memory caching. This test executes almost nothing but NOP ("No Operation") machine code instructions in a big 32K loop.

The **8086 Instruction Mix** benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 8086 instruction codes. These instructions are a subset of the total processor instruction set.

The **DOS Disk Access** benchmark test measures the time it takes to do a random sector read using DOS. DOS buffers are set at 3 and the interface factor is left at the driver's default setting. This test adds DOS's overhead to the BIOS and hardware times. The test program performs the sector read 1,000 times within the DOS disk partition. The average result is shown in milliseconds.

### Relative Times (Base: IBM PC-XT = 100)



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- socket for 80287 math co-processor!



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MathPlan is the powerful spreadsheet program that matches the number one spreadsheet feature-for-feature, with a number of important extras, including compatibility with WordPerfect. MathPlan spreadsheets can be integrated with WordPerfect text. In addition,

MathPlan gives you bit-mapped graphics for high-resolution charts and graphs.

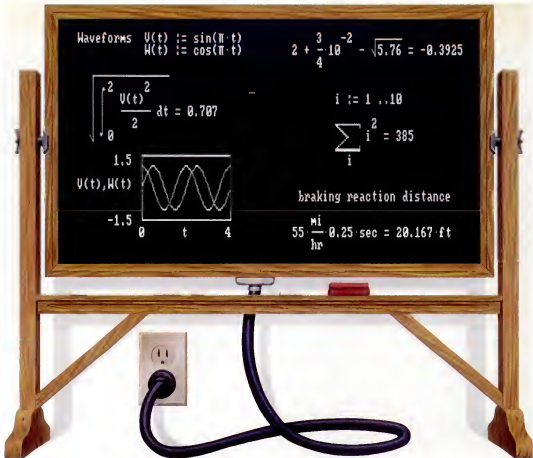
WordPerfect Library is a collection of utilities and functions which make it easy to integrate WordPerfect, MathPlan and other programs. The Library Shell allows you to put multiple programs into memory so you can switch back and forth quickly and easily. The Clipboard lets you move information between programs. The Library also includes a multi-function Calculator, Calendar, Directory Manager, Mail-list Manager/Auto-dialer, Macro Editor, and Text Editor.

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# MathCAD

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CIRCLE 154 ON READER SERVICE CARD

# First 1-2-3 Add-In from Enfin Solves Problems in Reverse

**PC HANDS ON**

BY JARED TAYLOR

It has finally happened. Lotus's 1-2-3 can now be a true working environment, just like *Symphony* and *Framework*.

*Goal Solutions*, from Enfin Software Corp., is only the first of a whole flock of add-in applications that will soon allow you to do everything from word processing to linear programming without leaving the comforts of Lotusland. And this brand-new trick is a 1-2-3 retrofit, not an update. *Goal Solutions* comes with its own add-in manager that you piggyback onto your current 1-2-3 driver set with one simple command.

## Uses 72K of RAM

Once you have retooled your drivers, you load 1-2-3 and hit Alt-F10. Instead of a beep, you now get a menu that lets you attach add-ins. This modification takes about 20K bytes of memory, and *Goal Solutions* itself takes another 52K when attached, so you have 72K less RAM for spreadsheets. (With *Symphony*, you have an add-in

manager built in, so the memory loss is only 52K.) In return, you get real, backward what-if analysis.

Spreadsheets use formulas to get results from constants. "Profits = (Unit Price × Number of Units Sold) - Expenses" is a formula that calculates profits from the other numbers. If you change unit price, profits change.

But what if you want to know the unit price you'd need for a particular profit? You

would have to keep guessing at the right number until you got it right—it's easy to change the results of a formula by changing a value, but you can't go the other way. *Goal Solutions* does the backward problem solving for you. You use menus and pointing to tell it how much profit you need and that it should adjust unit price to get them. With complex models, you can specify up to five target values and let *Goal Solutions* adjust up to five other num-



Normally transparent, *Goal Solutions* attaches itself to 1-2-3's drivers and can be called from within a spreadsheet anytime at the press of Alt-F10.

**PC FACT FILE**

### Goal Solutions

Enfin Software Corp.  
6920 Miramar Rd., #106A  
San Diego, CA 92121  
(619) 549-6606  
List Price: \$79.95

**Requires:** *Symphony* or 1-2-3, Release 2 or later; 72K additional RAM with 1-2-3, 52K with *Symphony*, DOS 2.0 or later.  
**In Short:** The first add-in released that will run under 1-2-3 or *Symphony*, *Goal Solutions* will work backward to find the correct values to satisfy selected criteria. Not copy protected.

CIRCLE 489 ON READER SERVICE CARD

bers to reach those values.

If you did that by hand, it would take all day and you might never get it right. *Goal Solutions* works by trying repeated recalcs, too, but it makes very well educated guesses. Large spreadsheets will slow it down, but it still works much more quickly than you ever could. If you know 1-2-3 or *Symphony*, *Goal Solutions* is easy to learn and use. It installs in a snap, has decent on-line help, and can save you a lot of time if you like to solve backward.

# Htest/Hformat Diagnostics Bring Hard Disk Settings Within Reach

**PC HANDS ON**

BY EDWARD MENDELSON

*Htest/Hformat Advanced Hard Disk Diagnostics* is a group of programs that can fine-tune a sluggish hard disk for faster performance or jump-start a disk that doesn't run at all.

## Controller-Level Format

The main *Hformat* program performs a controller-level format of your disk, the kind normally done by the manufacturer. This is the deepest for-

mat—it precedes FDISK and the high-level FORMAT in DOS—and its job is to lay down a disk's tracks and set its interleave. If the interleave is wrong (as it often is, even when set at the factory), your disk seems to be spinning in molasses. The Hoptimum utility finds the best setting for any combination of disk and controller so that *Hformat* can flush out the molasses. You will have to restore all your data if you change the interleave, but the acceleration may be worth it.

A disk's first track contains

its partition record, which can't be touched by DEBUG and is invisible to DOS. But if a program or protection scheme runs amok and destroys that track, DOS won't believe you have a disk at all. Barring catastrophic physical damage, *Hformat* can clean up the corrupted track and restore the partition record while leaving the directories and FAT alone.

With luck you'll never use this program, but it could be a lifesaver if you ever need to recover irreplaceable data in a hurry.

**PC FACT FILE**

### Htest/Hformat Advanced Hard Disk Diagnostics

Paul Mace Software  
123 First St.  
Asland, OR 97520  
(800) 523-0258  
(503) 488-0224  
List Price: \$89.95

**Requires:** Hard disk and floppy disk drives, DOS 2.0 or later.  
**In Short:** A low-level format program for hard disks, with many options and exhaustive test procedures. Not for daily use but for emergencies and overhauls. Not copy protected.

CIRCLE 421 ON READER SERVICE CARD





## MCI Mail Is Linked to LAN Products, Furnishes Users with New Flexibility

In the wake of Lotus Development Corp.'s recently announced *Express*, a front-end for MCI Mail (see review, page 35), two more companies have announced product interfaces with the e-mail system.

3Com Corp. has announced *3+Reach/MCI*, a \$600 network software application that electronically links 3Com's *3+Share* network operating system and MCI's electronic mail service. *3+Reach/MCI* lets 3Com network users send messages to any MCI Mail user, to any Telex address around the world, or to any street address through MCI postal delivery capabilities.

The program also automates the electronic mail service, notifying users when an MCI message is waiting. *3+Reach/MCI* was developed with the *3+Reach/Toolkit*, a \$300 developer's tool kit for applications that use the communications resources of the *3+Share* LAN operating system.

Meanwhile, **Consumers Software** has introduced the *Network Courier/MCI Mail Gateway*, which works in conjunction with Consumers' *Network Courier* LAN e-mail sys-

tem to allow PC LANs to link and share DOS files by using MCI Mail as their common backbone.

Running on a single LAN, *Network Courier* allows users to send mail and DOS files to other LAN users without leaving their applications programs. Just like Lotus's *Express*, *Network Courier* operates in the background. **List Price:** *3+Reach/MCI*, \$600. **Requires:** 384K RAM, *3+* network, Hayes-compatible modem, MCI Mail Account. Not copy protected. *3+Reach/Toolkit*: \$300. Not copy protected. 3Com Corp., 1365 Shorebird Way, Mountain View, CA 94043; (415) 961-9602.

CIRCLE 427 ON READER SERVICE CARD

**List Price:** *Network Courier/MCI Mail Gateway*, \$395. **Requires:** 192K RAM on server, *Network Courier* LAN e-mail system, NETBIOS-compatible LAN, Hayes-compatible modem. Background operation on user's PC requires 50K free RAM and MCI Mail account. Not copy protected. Consumers Software Inc., 8315 Monterey St., Suite A, Gilroy, CA 95020; (408) 848-3385.

CIRCLE 428 ON READER SERVICE CARD

## Bocaram/AT Memory Board Runs at 16 MHz With up to 4 Mbytes

The newest member of Boca Research's low-cost memory board family is the Bocaram/AT, designed for ATs and XT 286s. Unlike most other memory boards, the board can be operated at CPU speeds of up to 16 MHz. It can be configured with up to 4 megabytes of memory. Boca offers several configurations: a choice of 128K bytes of conventional memory for use in bringing total system RAM to 640K bytes; up to 2 megabytes of Lotus/Intel/Microsoft expanded memory specification (LIMS EMS) RAM; or up to 4 megabytes of non-EMS-compatible extended memory. **List Price:** Bocaram/AT, with 128K RAM of conventional memory, \$245; 1 Mbyte, \$395; 2

The Bocaram/AT, which can run at clock speeds up to 16 MHz, can be configured with either EMS or extended memory.

Mbytes, \$595; 4 Mbytes, \$995. Boca Research Inc., 6401 Congress Ave., Boca Raton, FL 33431; (305) 997-6227.

CIRCLE 434 ON READER SERVICE CARD

## Half-Card 80286-based Accelerator Brings Memory Cache to Compatibles

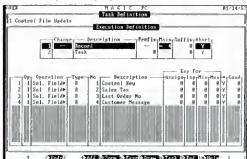
MicroWay's 80286-based FastCache-286 will take your PC or compatible all the way up to 9 or 12 MHz, while taking up only one short slot on your bus. FastCache-286 has 8K bytes of 55-nanosecond, no-wait-state cache memory and comes in versions that run at 9 MHz (\$499) or 12 MHz (\$599). The board asynchronously emulates

## Magic PC Produces Database Applications Without Programming

If the thought of programming your own database applications makes you tremble, perhaps *Magic PC*, \$695 from Aker Corp., is for you. The applications generator saves users from the need to deal with much-dreaded computer language

ed, *Magic PC*'s inference engine develops the information provided by the user into a single file that contains both the database and program library.

**List Price:** *Magic PC*, \$695 for unlimited users in a LAN installation. *Magic Run*, \$95 for each standalone application runtime module. *PC Magic Trial*, \$19.95, including complete *Magic PC* software limited to 100 records,



Magic PC generates database applications through use of execution tables filled out by the user, who is not required to write any computer language code in the process.

code. Applications are created by filling in execution tables and information banks that are presented to the user through a series of pop-up windows. Each execution table entry is a discrete operation that manipulates data in a true relational database environment, Aker says.

After the tables are complet-

ed, a 450-page tutorial and reference manual, and a sample order-entry application. **Requires:** 512K RAM, hard disk, DOS 2.0 or later. Not copy protected. Aker Corp., 18007 Skyway Circle Dr., Suite B2, Irvine, CA 92714; (714) 250-1718.

CIRCLE 429 ON READER SERVICE CARD



speed up screen operations. Caching of EEMS memory can be disabled, which makes the board compatible with both EMS and EEMS memory specifications.

**List Price:** FastCache-286, 9-MHz version, \$499; 12-MHz version, \$599. **Requires:** IBM PC, XT, or compatible. MicroWay Inc., P.O. Box 79, Kingston, MA 02364; (617) 746-7341.

CIRCLE 426 ON READER SERVICE CARD

## ■ QUICK LOOKS

## The \$99 Economouse: Aptly Named

PC HANDS ON

BY MITT JONES

When you take a close look at International Microcomputer Software's new mouse, you understand why it was named the Economouse: when your product is run-of-the-mill, you'd better market it as being cheap.

The \$99 Economouse's deficiencies might not be worth the few bucks it saves. Like many mice, the three-button, trackball Economouse plugs into a serial port. But in a rather odd scheme, the mouse draws its power from a transformer that hogs one of your electrical outlets and plugs into the serial port, contributing to the tangle of wires behind your computer.

IMSI claims the Economouse is Microsoft Mouse com-

patible, and it worked well with most programs I tried. However, I couldn't get the mouse to work properly with *Microsoft Word*, even after consulting IMSI's technical support. The



The Economouse comes with a second tail for plug-in power.

company also reports problems getting the mouse to work properly with *GEM*.

The Economouse works with *Microsoft Windows*, but only after you install a special driver IMSI supplies. To install the driver you must copy it onto your *Windows* Setup disk and reinstall *Windows* from scratch. I had to delete a few files from the Setup disk to make room for the driver, a nuisance I could've lived without.

Drivers for other popular programs, such as *1-2-3*, are conspicuously missing. However, IMSI supplies a keystroke driver that partially makes up for the deficiency. I was able to use the mouse for simple cursor movement in every program I tried, whether it supported a mouse or not, and an exceptionally easy-to-use menu generator

lets you build interfaces for any application. The 23-page user manual is adequate for installation and basic use but fails to answer some advanced-topics questions. The mouse works as well mechanically as any mouse I've used, but its Microsoft Mouse compatibility problems and lack of applications drivers are serious drawbacks—drawbacks that easily justify the slight price jump to a Logitech, Mouse Systems, or Summagraphics mouse—all of which are truly Microsoft compatible.

Kraft Systems manufactures the Economouse and offers the same mouse and software under the Kraft label for \$99.95.

**List Price:** Economouse, \$99.

**Requires:** Serial port and electrical outlet. International Microcomputer Software Inc., 1299 Fourth St., San Rafael, CA 94901; (415) 454-7101.

CIRCLE 435 ON READER SERVICE CARD

## Flawed JumpStart: Going Nowhere Fast

PC HANDS ON

BY CATHERINE D. MILLER

It would be nice to have a program that included telecommunications with my favorite desktop utilities. *JumpStart*, from Epson America, seemed like it might be the one. It includes a communications module along with an address book, an appointment book, a financial calculator, a text editor, and DOS utilities.

Unlike some other desktop utility programs—such as Borland's *SideKick* and Lotus's *Metro*—*JumpStart* is not memory resident. And for me, this is only the beginning of the problems inherent in the program's design.

The financial calculator can't deviate from 18 specific financial calculations. You can't scroll through the entries in your address book. The limited text editor fails to perform a simple search successfully and doesn't interact with any other module in the program. The

communications module is slow and difficult to use.

After using *JumpStart*, I would be inclined to rename the program "PushStart." Its de-

sign flaws and nonintuitive command structure make it a poor choice for the novice user, who is the program's unfortunate target.

**List Price:** *JumpStart*, \$66.

**Requires:** 256K RAM, DOS 2.0 or later. Not copy protected. Epson America Inc., 2780 Lomita Blvd., Torrance, CA 90505; (213) 539-9140.

CIRCLE 436 ON READER SERVICE CARD

## Detailed Handbook of BASIC Fills a Gap

PC HANDS ON

BY ETHAN WINER

A lot of books have been written about programming in BASIC, but David I. Schneider's *Handbook of BASIC for the IBM PC* is one of the most complete and thorough yet. More than just a reference for BASIC's numerous commands, it also contains a wealth of useful examples and program fragments. And while it is organized much like the BASIC manual that comes with most PCs, any further similarity ends there.

Each BASIC statement and function is described in great detail, with many discussions spanning ten or more pages.

Particularly engaging are the descriptions of the DRAW and PLAY commands since these two are based on a series of codes that actually comprise a "mini language" in their own right. Besides the usual ASCII charts and character tables, separate chapters are devoted to communications, reading and writing disk files, graphics, mathematical concepts, and much more.

This book does not cover the newest versions of BASIC such as Microsoft's QuickBASIC and Borland's TurboBASIC; however, it gives a good treatment of many of BASIC's newer features. It often provides valuable differentiation between early and advanced

BASIC features. Information on accessing device drivers using the IOCTL (Input/Output Control) command is all but ignored in the IBM BASIC manual, and the added coverage provided here is important and appreciated.

Though the writing style is not always as fluent as it could be, there is no disputing the quality of its content or the depth of its coverage.

**List Price:** *Handbook of BASIC for the IBM PC*, by David I. Schneider, \$22.95. Copyright: 1985. ISBN#: 0-89303-510-6. Brady/Prentice Hall Press, One Gulf + Western Plaza, New York, NY 10023; (212) 373-8500.

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CIRCLE 360 ON READER SERVICE CARD

# Rodime Goes Public with Top-Quality 45-Meg Disk on a Card

**PC HANDS ON**

BY MITT JONES

Rodime has been quietly shipping the latest in hard disk technology to computer manufacturers for years.

But now you can buy the latest in hard-card technology straight from Rodime. The Scottish company's first disk on a card, the R-Card 45, with an average random access time of 28 milliseconds, dethrones Plus Development's Hardcard 20 as the fastest hard card tested by PC Magazine.

Rodime packs four plated platters and a voice coil actuator into the 45-megabyte R-Card. Six of the eight surfaces are for data, and one is a dedicated servo surface. The R-Card uses MFM encoding with an interleave factor of 3.

The card plugs into any full-length slot but occupies the back half of the slot to the left, as well. If you reposition the speaker on your XT, you can fit the card into the leftmost slot.

The R-Card draws power directly from your power supply rather than through the bus. You plug a cable Rodime provides

into a spare power supply socket or wye into the cable leading to either of your floppy disk drives. You then format your drive and partition it into as many as eight logical units using software Rodime provides.

The card will draw 17 watts of power during typical use, but you should ensure that your power supply can handle the rated maximum draw of 27 watts.

Rodime has been around

longer than the PC, and by all indications the R-Card is everything you'd expect from a pro.

But state-of-the-art speed has its price—\$1,495 for the R-Card 45 and \$1,295 for Rodime's equally-fast R-Card 35. If speed isn't your top priority, one of the hard cards PC Magazine rated in "Sliding in Memory: 14 Hard Disk Cards" (Volume 6 Number 3) may be a better choice.

**PC FACT FILE**

## R-Card 45

Rodime Inc.  
Peripheral Systems Div. 29525  
Chagrin Blvd.  
Pepper Pike, OH 44122  
(216) 765-8414  
List Price: \$1,495

Requires: DOS 2.0 or later.

**In Short:** A high-quality, high-speed 45-Mbyte hard disk on a card for PCs, XTs, ATs, and compatibles.

CIRCLE 436 ON READER SERVICE CARD

**PC MAGAZINE**

## Benchmark Tests: Rodime R-Card 45 vs. IBM PC-XT 10-Mbyte hard disk and Plus Development Hardcard 20

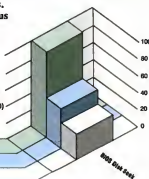
The Rodime R-Card 45's and the Plus Development Hardcard 20's voice coil actuators account for the dramatic speed difference when compared with the IBM PC-XT's stock drive. The R-Card 45 steps ahead of the Hardcard 20 thanks to complete servo control and a faster controller.

### Performance Times (Times given in milliseconds)

Product	BIOS Disk Seek
IBM PC-XT 10-Mbyte hard disk	95.00
Plus Development Hardcard 20	44.00
Rodime R-Card 45	28.08

The BIOS Disk Seek benchmark test measures the time it takes to do a random seek using the disk's ROM BIOS. The test result includes minimal software overhead and may not parallel the

**Relative Times**  
(Ratio: IBM PC-XT  
10-Mbyte hard disk = 100)



manufacturer's claimed average access time. The test program performs 1,000 seeks. The average result is shown in milliseconds.

## Voice Coil Actuators Mean Fast Disks

Voice coil actuators improve access times and allow higher drive capacity. To move the heads, the controller sends current through the actuator arm's coil, which creates a magnetic flux and causes the arm to pivot.

In a typical band stepper actuator, a flexible metal band, which is connected to a rotary motor, pushes the heads across the platters. The controller sends electrical pulses to the motor, moving the heads in increments instead of in one quick movement.

The voice coil actuator can move the heads across a platter nearly as quickly as they can

move the heads across one track, whereas band stepper actuators in effect move across the platter one track at a time.

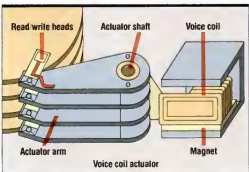
Voice coil actuators also use some sort of servo control to speed up head positioning and keep heads more precisely positioned, allowing tracks to be packed more tightly on each platter for higher drive capacity. The R-Card makes use of a closed-loop system—one surface of one disk platter is used as a servo surface, storing only the cylinder identification information. At any given time, the controller knows exactly where the heads are placed and can

adjust the position quickly.

In open-looped band stepper systems, there is no servo con-

trol and the controller has no direct indication of head location.

—Mitt Jones





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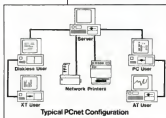
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product names are trademarks of their respective owners.



# Turbo Pascal Toolbox Teaches Numeric Routines by Example

**PC HANDS ON**

BY STEPHEN RANDY DAVIS

Borland International has done this sort of thing before. It introduces collections of useful Turbo Pascal routines, which it calls toolboxes, both to give programmers superbly written source code examples to follow and to aid them in developing their own applications. Previous toolboxes centered on subjects such as graphics, databases, and games.

Borland's latest offering, *Turbo Pascal Numerical Methods Toolbox*, is a collection of mathematical routines.

These numeric routines might have been first developed for the company's soon-to-be-released equation solver named *Eureka!*. They include matrix manipulation functions, differentiation and integration of user-supplied functions, curve fitting, and Fast Fourier Trans-

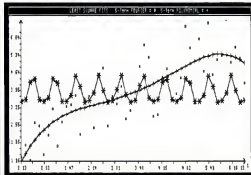
formation (FFT) routines.

There is no "filler" here. Every routine provides a useful, nontrivial function.

Each algorithm comes in a separate file designed to be included in the user's application program. Each is fully documented with a description of what it does and what the inputs

and outputs are. Just in case that isn't enough, each routine has a companion .PAS sample program as an example.

The 300-page manual contains short descriptions of the theory of each algorithm. It also explains in detail how to get meaningful results out of each of the example routines. A



This graph of least-square fits of power, exponential, and logarithmic functions to some sample data is one of the toolbox routines. The disk supplies Turbo source code, and the manual discusses the program's design.

**PC FACT FILE**

## *Turbo Pascal Numerical Methods Toolbox*

Borland International Inc.  
4585 Scots Valley Dr.  
Scots Valley, CA 95066  
(408) 438-8400

List Price: \$99.95

Requires: Turbo Pascal 2.0 or later, DOS 2.0 or later, 8087 or 80287 recommended.

In Short: A collection of number-messaging routines that you can work into your Turbo Pascal applications. Not copy protected.

CIRCLE 429 ON READER SERVICE CARD

demo disk is included to demonstrate what a powerful combination this toolbox makes with the separately available *Turbo Graphics Toolbox*.

If you consider a boundary value problem to be an international dispute, then this may not be for you. But if you even occasionally write programs to analyze numbers, the *Numerical Methods Toolbox* is a must addition to Turbo Pascal.

# Flash-Up Windows Simplifies Creation of Custom Interfaces

**PC HANDS ON**

BY GLENN HART

There are scads of shell programs that attempt to isolate beginners from the complexities of DOS. Many of the shells do a fine job, but often the shells themselves are pretty complicated. As general-purpose tools, they also often include more than is really necessary in a given office.

## Customized Interfaces

That's why many system administrators and programmers like to "roll their own" user interfaces. Creating a custom menuing system lets you tailor

what the user sees to your own personal conception of what's appropriate.

Unfortunately, the tools for creating your own menu system are difficult to use and don't always produce professional results without a lot of effort. *Flash-Up Windows*, from Software Bottling Co. of New York, lets you create and display pop-up menus and help windows quickly and painlessly.

The menus you create use a horizontal light-bar cursor. You move the bar to the desired choice and hit Return or type the first letter of the command, a la 1-2-3. When the choice is made, the program types a string of characters, just as if

you had typed them manually at the keyboard. The string can be routed to the printer instead if you wish, which is handy for controlling printer behavior, or it can be fed to a high-level program that may have called the screen.

## Help Windows

When you design the menu window, you can attach help windows to each menu option. The help message will pop onto the screen as the light-bar cursor is moved from one selection to another. *Flash-Up Windows* also lets you create text-only pop-up windows to add context-sensitive help to almost any application.

**PC FACT FILE**

## *Flash-Up Windows*

Software Bottling Co. of New York  
6600 Long Island Expy.  
Maspeth, NY 11378  
(718) 458-3700

List Price: \$90

Requires: 256K RAM, DOS 2.0 or later.

In Short: An easy-to-use system for setting up menus and help screens in other applications. Not copy protected.

CIRCLE 434 ON READER SERVICE CARD

You simply paint your windows on-screen in *Flash-Up Windows'* editor. An assortment of function keys and attractive screens let you resize or move a window, change its border,

(continues on page 54)



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CIRCLE 394 ON READER SERVICE CARD



## ■ PC UPDATE ■ PEGGY GAVAN

Epson America has cut the prices on three models of its **Equity 1** PC compatible and on several of its dot matrix printers. The price of the **Equity 1** with 256K bytes of RAM and one floppy disk drive dropped \$200, to \$795, and the price for the dual-drive model fell \$300, to \$995. Epson slashed \$500 off the price of an **Equity 1** with a 20-megabyte hard disk, which now costs \$1,395. In addition, Epson cut \$100 off the price of the **LQ-1000**, **LQ-800**, and **EX-800** printers and reduced the cost of the **LX-86** by \$50. Epson America Inc., Torrance, Calif.; (213) 534-4500.

Quadram Corp. has begun shipping a 1-2-3 software driver with its **QuadEGA ProSync** graphics board. The new driver offers users of 1-2-3, Release 1A, the ability to display 120 columns by 25 lines; users of 1-2-3, Release 2.0, have the option of a 120-column by 43-line format. Quadram will ship the driver to ProSync owners at no charge. Quadram Corp., Norcross, Ga.; (404) 923-6666.

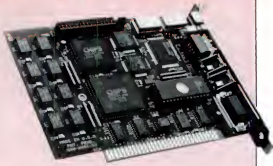
Persoft has released **SmartTerm 220**, Version 1.2, and **SmartTerm 400**, Version 3.2, with an optional network kit. The kit, priced at \$50, allows users to communicate with host computers through the Ungermann-Bass **Net/One** or Bridge Communications **EtherTerm** network system. **SmartTerm 220** and **SmartTerm 400** are priced at \$195 and \$149, respectively. Upgrades are \$50 for registered users. Persoft Inc., Madison, Wis.; (608) 273-6000.

Compaq Computer Corp. has reduced the price of its **Deskpro Model 2** from \$2,399 to \$1,699, a reduction of 30 percent. In addition, the company has discontinued its 128K-byte, single-floppy **Deskpro Model 1** and the 640K-byte, single-floppy, 20-megabyte hard disk **Model 3**. Compaq Computer Corp., Houston, Tex.; (713) 370-0670.

Generic Software has released **DatPlot**, a \$24.95 productivity module that allows users of **Generic CADD**, Version 2.0, to reproduce CAD drawings on dot matrix printers. With the **DatPlot** module, users can rotate drawings 90 degrees, fit them to paper size, and scale them to desired size. Generic Software Inc., Redmond, Wash.; (206) 885-5307.

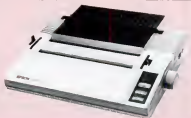
Maynard Electronics is now shipping the **MaynStream Tape Backup System**, Version 2.0, with its line of internal and external tape backup systems. The new software has several added features, including backup performance during network operation, password protection, and file marking, which allows users to mark only those files they wish to back up. Upgrades to Version 2.0 are free to MaynStream owners enrolled in Maynard's upgrade program. Maynard Electronics, Casselberry, Fla.; (305) 331-6402.

In brief: Walonick Associates has added a forecasting module to its **StatPac Gold** statistical analysis software. The new module, priced at \$195, adds 11 forecasting methods, exploratory data analysis, and quality-control analysis. Walonick Associates Inc., Minneapolis, Minn.; (612) 866-9022. . . . Turner Hall Publishing is selling



Quadram Corp. is shipping a 1-2-3 software driver with its QuadEGA ProSync graphics board that allows 1-2-3 users to display up to 120 columns.

Cambridge Software Collaborative's **Spreadsheet Auditor** package at a reduced price of \$99.95 until July 31. The three add-on programs included in the package—**The Spreadsheet Analyst**, **The Macro Analyzer**, and **The Spreadsheet Comparator**—cost \$230 if purchased separately. Turner Hall Publishing, Cupertino, Calif.; (408) 253-9607. . . . **R-Doc/X**, Version 3.1, can transfer files written in IBM **DCA/RFT**, IBM **Writing Assistant**, **OfficeWriter**, **PFS:Write**, and **xyWrite** formats. Upgrades for registered users of Version 2.2 are \$37.25. Advanced Computer Innovations, Rochester, N.Y.; (716) 454-3188. . . . HomeCRAFT Computer Products, previously Nickelodeon Software, has combined its **Home Maney Manager II**, **Home Insurance**, and **Home Loan** programs into one package, called **The HMM Personal Asset Manager**. The new package is priced at \$129.95. Upgrades are \$40 for **HMM-II** users and \$95 for registered users of **Home Insurance** and **Home Loan**. HomeCRAFT Computer Products, Tualatin, Ore.; (503) 692-3732. . . . Consumers Software is offering a low-cost version of its **Network Courier** e-mail program for small networks with up to six PCs. The new version, which has the same functions as the \$695 standard version, is priced at \$295. Consumers Software Inc., Gilroy, Calif.; (408) 848-3385. . . . **Primulity**, Version 5.5, has several new features, including downloadable character fonts and support for the IBM Enhanced Graphics Adapter. Upgrades to the \$179 program are free to registered users. Metro Software Inc., Tucson, Ariz.; (602) 299-7313. . . . **SQLBase**, Version 3.1, supports distributed data access across multiple server nodes and features an **SQL** programming interface for **Microsoft Windows**. **SQLBase** is priced at \$1,995 for the multiuser version and \$995 for the single-user version. Upgrades are free to customers participating in Gupta Technologies' warranty program. Gupta Technologies, Menlo Park, Calif.; (415) 321-9500. . . . Tseng Laboratories has upgraded the BIOS in its **EVA/480** EGA board. New features include monochrome and color support in the 132-column mode and a zoom "hot key" for pixel editing in interactive programs. Upgrades are \$10 for registered owners. Tseng Laboratories, Newtown, Pa.; (215) 968-0502. . . . Delta Technology International has released a network version of its **Direct Access** menu system. **Direct-Net**, Version 1.1, will sell at an introductory price of \$195 until April 30, when it will retail for \$245. Until May 1, 1987, upgrades are \$119 for registered users who purchased **Direct Access** after October 1, 1986. Delta Technology International, Eau Claire, Wis.; (715) 832-7575. . . . The **Tekmar Graphics Library**, \$195, is now compatible with the IBM Enhanced Graphics Adapter. Upgrades are \$95 for registered users. Advanced Systems Consultants, Chatsworth, Calif.; (818) 407-1059.



Epson America has cut the prices on several of its dot matrix printers, including the LX-86 and LQ-800, and slashed prices on three models of its Equity 1 PC

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## ■ FROM THE EDITOR'S SCREEN ■ BILL MACHRONE

# SATURDAY NIGHT LIVE SOFTWARE



*Is it a keyboard macro or a floor wax? Is software getting better? Or just more confusing? Several new feature-laden products refuse to be neatly cataloged or categorized.*

A classic edition of NBC's "Saturday Night Live" included a skit in which Dan Aykroyd appeared just as an actress went overboard garnishing some freshly-made pudding—as she sprayed what looked like whipped cream all over her kitchen.

"No problem," he mugged into the camera as he held up a can of the stuff and bent down to massage the white goo into the linoleum, "it's a dessert topping . . . and a floor wax!"

And that's where the software market is today. A new class of products cuts across traditional classifications and definitions—and runs into a wall of confusion.

Back in my early personal computer days, I remember downloading a public-domain disk utility program from one of the local bulletin boards. In the documentation, the program's author, Ward Christensen, sheepishly admitted that it suffered from a disease: rampant featuritis. The program did so much and had so many modes and commands that it was daunting. It replaced at least three lesser programs.

We see an incredible number of new products at *PC Magazine*, both those that arrive in the mail and those demonstrated by their authors. Every so often, during a demo, I'm reminded of Ward's phrase and the "Saturday Night Live" skit.

It creates a real problem for us. We're in the business of categorization and comparison. It gets much harder to compare products when one of them stands out from its peers with a completely new spectrum of features.

A perfect example of this is *Words and Figures*, from Lifetree Software. Is it a word processor with a spreadsheet? A spreadsheet with a word processor? Or is it integrated software? Do you test it against *PFS:First Choice* or *Enable*? Either? Both?

The answer, of course, and unfortunately, is both. We have to tell you whether the word processor is so bad that it overrides the spreadsheet, or how close to 1-2-3, Release 1A, the spreadsheet really gets. It's more work that way, but a fairer review.

**WINDOW WONDERS** We encountered a similar problem with The Software Bottling Co. of New York's *FlashUp Windows*. This product is a collection of utility programs that help you create and execute windowed pop-ups. It also has a comprehensive keyboard macro system, so you can give programs features that they didn't

come with. The windows can be text, files, other programs, anything you want. It's easily programmable and incredibly flexible. Thus it could be an on-line help system for a program that doesn't have one or a custom menu system for applications developed in-house. Or it could be a DOS shell. The price for this power is confusion.

Product demonstrations at *PC Magazine* are usually much more than show-and-tell. They are heavily interactive, with the editors expressing their likes and dislikes and offering suggestions for ways in which the product could be improved. Every time we made such a suggestion while watching *FlashUp Windows*, the demonstrator responded with, "It can do that, too." Then he'd open an edit window, write a few lines of code, and show us.

Since *FlashUp Windows* doesn't compare directly to anything else out there, it's hard to draw comparisons. Put another way, it doesn't have any competition. But competition dignifies a market and makes it more comprehensible.



**SIDEKICK AND BEYOND** Lotus's new *Metro* is another case in point. It's an all-things-are-possible terminate-and-stay-resident (TSR) program. It can potentially replace most, if not all, of the TSRs you customarily use. With its calculator, notepad, editor, dialer, calendar, symbol table, and DOS shell, *Metro* could replace *SideKick* as the leading TSR. When you add in its keyboard macros, it has a shot at replacing *SuperKey*, too. Then you find out that it has an outline/text-oriented database, as

## ■ FROM THE EDITOR'S SCREEN

well. The mind begins to boggle when you see that the macro language has branching and conditional logic and can create menus, invoke other programs, and interact with the user. And it lists for \$85.

Lotus is actively seeking third parties to create additional "accessories" for *Metro*, too. So it will become even more far-reaching and powerful. Along the way it will also become something of a mini-mul-

titasking operating system, swapping accessories in and out of memory as needed.

With all this, Lotus is careful to say that *Metro* is not a replacement for *SideKick* and can, in fact, coexist with it. When you're marketing a veritable shelfful of products, it's important not to be branded as a dessert topping or a floor wax.

Word processors, as a class of products, have gotten so big and feature-rich as to approach incomprehensibility. First the general features: in addition to editing, formatting, and printing, they now customarily offer spelling checkers, thesauri, and advanced document formatting. Then there are specialized features such as combined text and graphics, document/revision control, and document interchange with mainframes and networks.

In a single-topic issue devoted to word processing, *PC Magazine* codified WP's three major categories just over a year ago: personal, professional, and corporate. The personal word processor does triple duty as a text editor, light word processor, and program editor. The professional word processor needs much more power in document formatting, spelling checking, and outline processing. The corporate word processor must be easy to use and easier to train on, since it will be used by secretarial, clerical support, and word processing pool personnel alike. It must also work well over corporate and local networks.

These categories are still valid, but many WP products try to span categories. The challenge, obviously, is to span the professional and corporate categories, since that's where the money is.

So the product managers pile on the features. The feature explosion prompted one reader to write, "Instead of saying that *Microsoft Word* gets better and better, perhaps you should say that it gets bigger and bigger." It wants a couple of megs of your hard disk and as much RAM as you can spare. Lotus's *Manuscript* is even more of a memory hog. You have to take all your memory-resident programs out just to get it running. These programs are the equivalent of Rutan and Yeager's *Voyager*: Give them a couple of miles of runway, and you can fly them around the world.

The product designer's desire to make products even more powerful makes them even more confusing. It's inevitable. ☐

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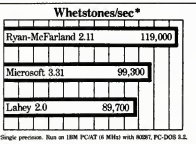
Those aren't benchmarks Ryan-McFarland picked to make their FORTRAN look good. They're the industry standards.

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has a cross reference compile option, supports assembler and C subroutine calls, IEEE floating point, 8087 and 80287 chips.

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It features advanced 12-MHz 80286 technology that enables you to run programs written for 8-MHz personal computers up to 50% faster without sacrificing compatibility. And it offers enough RAM to satisfy even the

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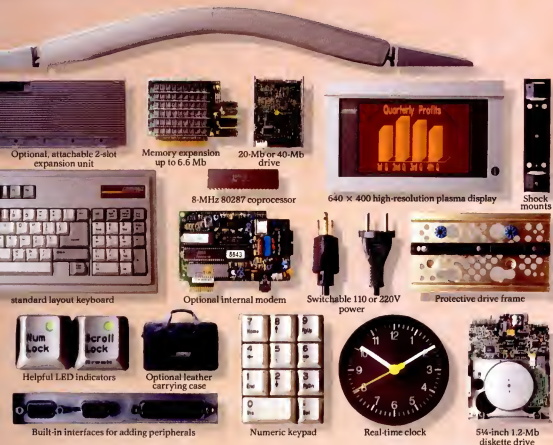
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5 1/4" diskettes

We didn't stop there. Notice the full-size standard keyboard with a numeric keypad. The industry-standard 5¼-inch diskette drive compatible with the rest of the business world. The full-size, adjustable 640 × 400 high-resolution plasma display, which conveniently provides text and graphics on one screen. Even an optional internal modem.

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high-capacity fixed disk drives. And not one offers the rugged, patented shock-mounting technology that's so important for the survival of a portable computer.

Their diskette drives are usually 3½" drives which make it impossible to use industry-standard 5¼" diskettes.

Compaq, on the other hand,

uses industry-standard fixed disk drives. And our drives maximize compatibility with your desktop personal computers, so you don't have to transfer your data. Plus, our detachable full-size keyboard doesn't force you to use one that's small and cramped.

Not one of our competitors can rival our memory and stor-

It feels like the others  
They did.

age capacity. The most RAM others offer is 2.6 Megabytes, which looks very small next to our 6.6 Megabytes. Storage is another story. The internal storage capacity of all our major competitors put together can't equal the storage capacity of a single COMPAQ PORTABLE III. We even offer an attachable, portable expansion unit, with

two full-size industry-standard slots so you can add features of your own.

It stands to reason that if our competitors had included *some* of the features we offer, chances are they would no longer be portables. This might be why Compaq sells more portable computers than any other company in the world.



# left something out.



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# we've lost a few pounds.



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We obviously designed the COMPAQ PORTABLE III for the open road. But what makes it exceptional is that it can also hold its own on a desktop. Its speed, memory, and storage capacity help it outperform most desktop PC's. As an executive power tool, it can handle your biggest spreadsheets and largest data bases. And its ability to network and communicate with

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■ JOHN C. DVORAK

# TOO MANY COLUMNS, TOO LITTLE TIME

*Here's everything you need to get started on a lucrative career as a computer magazine columnist, right on this page. Fame and fortune, guaranteed.*



People often ask me how can I write so many columns. "How do you get enough ideas? It must be a problem," they say. It turns out that the problem isn't getting enough ideas. The problem is getting too many ideas. I handle this overabundance of brain power with a semiannual do-it-yourself column in which I freely give away superb column topics and ideas that I simply don't have time to write because too many new ones are piling up. I suggest that you take at least one of these fascinating topics and write a few columns for a local magazine or newsletter. Here are the topics; take your pick.

The first topic is a rhetorical question: *Is it still possible to start a successful software company?* There are some who feel that the game is over. Others think that the big money is yet to be made. What do you think?

*Is there anything new in the world?* This column would discuss the fact that the electronic spreadsheet seems to be the only original idea put into practice on a microcomputer—and that this machine can do nothing other than act as an expensive typewriter and Rolodex.

*Can IBM make a comeback?* It's pretty pathetic that we can talk about a comeback for a company that totally dominates the computer industry already. Do we really want these guys to make a comeback? What would such a comeback be like? The topic is too scary for me to write about.

*Will Digital Equipment Corp. ever be a player?* DEC is always good material for a column or two. I remember when it was

first suggested that Digital would build a desktop machine. "DEC'll kill IBM. It knows all about little machines," was what industry pundits divined. Exactly why DEC can't perform well in the low end of the market is a mystery that is worth exploring.

*The future of the retail operation.* Since day one, observers have predicted that retailers cannot make money selling personal computers. Back in 1979 some guy claimed that they make all their money selling magazines. Now they don't even carry magazines. This idea immediately brings to mind another title: *How has computer retailing changed?* It seems to me that it has turned into a frightfully boring business.

*The BBS movement—"promises, promises."* Here's a good topic for the amateur sociologist. What ever happened to all the pie-in-the-sky hopes for the BBS movement? I don't know if you've noticed

but what were once called Community Computerized Bulletin Boards have turned into nothing more than software downloading services or clearinghouses for unusual cults such as druids or sadomasochism clubs. What happened? Druids, there seems to be an incredible interest in the Christian community in computers. Why are ministers in small churches so hopelessly enamored by the things? There are no less than two software companies that have put the entire Bible on disk. What's the attraction?

*Software broadcasting.* This one really cracks me up. In fact, I recently had lunch with a fellow starting up a new software broadcasting company. If you haven't heard of software broadcasting, it's a technique whereby you broadcast over the airwaves (usually on a subcarrier) software that can be received and put on disk by some guy with an antenna hooked to his computer. For some unknown reason (at least to me), there are people roaming around who think this is a fabulous idea. How do they get that way?

This brings me to my last topic: *an overview of all the crackpot schemes*, including the above. A whole article begs to be written about crackpot keyboards and input devices. And I'm not talking about the Dvorak keyboard, either. I'm talking about keyboards shaped like balls and keyboards with keys all over the place. And let's not forget foot pedals and microphones as input devices.

These ideas should get you started on a new and lucrative career as a computer columnist.

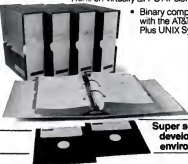


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■ JOHN C. DVORAK

# INSIDE TRACK

*To sweat or not to sweat. Turning an 80286 into an 80386 effortlessly.*

**H**ot-rodding the PC Dept.: The hottest project in Silicon Valley is the **once-secret Intel project** to design a new version of the 80386 chip that can use 16-bit memory and be pin compatible with the 80286 chip. At the same time it should be able to run all 80386 software and forthcoming 368-oriented operating systems.

The reason the company wanted to keep the project under wraps is that it fears that sales of the 80286 will dwindle. In other words, the company figures people will view the 80286 as some sort of **stopgap processor** and cease buying it.

My take is entirely different. If the product is truly pin compatible and can become a swappable chip (supposedly you can pull out an 80286 chip and drop in the 16-bit 80386 in much the same way a V-20 can be dropped into an 8088 slot), then I feel that people will gladly buy 80286 machines, knowing that the upgrade won't leave them with a **white elephant**. Unless the new Intel part requires extra support chips, there is no reason to wait for an 80386 machine—buy an 80286 and upgrade later.

**Meanwhile Dept.:** The rumors continue to fly about IBM and its future as a dominant force in the world of the desktop computer. The new operating system (still called ADOS as of this writing) has created a load of gossip stories. Let's summarize them by saying that it seems the product has been misnamed. It shouldn't be ADOS but, perhaps, **ADOG**. That must be the name because that's what everyone is calling it.

Besides the fact that far too many programs refuse to work properly running under ADOG . . . er . . . ADOS, it seems to be **noticeably slow**. Manufacturers of utilities tell me that few (if any)

of the utility programs that deal with disk I/O, and surely none of the packages that are memory resident, will work with the new operating environments. In fact, it seems that the little add-ons and fancy enhancements will only work if they are device drivers. That means that in your CONFIG.SYS file you'll have a slew of new **DEVICE=WIDGET.SYS** statements. "It will be worse than the memory-resident conflicts ever were," says one observer. There'll be dozens of device drivers fighting for the same interrupts. **Bombs away.**

As you begin to see this trend emerge in the next couple of years, take my advice, the same I give for memory-resident programs: **avoid programs that have rigid requirements such as "make sure this is the last device driver you load."**

**Genuinely Interesting Software Dept.:** While on the subject of utilities, I see that the successful Paul Mace (known best for his *Mace Utilities*) is publishing other obscure utility programs. One of the most interesting is **HTEST/HFOR-MAT** from Kolod Research. This is a hard disk utility that among other things has a utility called **HOPTIMUM**. This program optimizes the interleave of your individual hard disk for **maximum performance**. The interleave value of a hard disk refers to the way the sectors are laid out on a hard disk. They are scattered in such a way that the head won't miss them as the platter whirls by. The IBM PC is notorious for using an interleave that is **too conservative**, thus hurting performance. But determining the exact interleave for maximum performance has, until now, all been by trial and error. This does it for you by trying and testing various interleaves automatically. The package includes other nifty

hard disk utilities, too. It's \$89.95 from Paul Mace Software. Call (503) 488-0224 or write Paul Mace Software, 123 N. First St., Ashland, OR 97520.

**You Have to Wonder Dept.:** Performance nuts are still moaning about the slow speed of the PostScript drivers cropping up in desktop publishing packages. Taking an hour to output a complex logo isn't acceptable in this day and age. Perhaps it's why Hewlett-Packard has gone its own way. **The hot rumor** is that HP will introduce a faster interface processor PC card that will blow PostScript and the LaserWriter away. I've heard ten times faster. I'm prepared to believe three times faster. But then again, a banana slug is faster than a LaserWriter.

**This brings me to a point of information.**

How does one deal with the concept of "desktop publishing"? What exactly does it mean? Our illustrious West Coast editor, Stew Alsop, likens it to nothing more than a vertical application. It's not a world unto itself. It's more like a spreadsheet program. And like a spreadsheet it moves around **chunks of data** for the purposes of producing a fancy output. In the case of a spreadsheet, the fancy output is a printed spreadsheet. The desktop publishing package produces a fancy letter or brochure or newsletter.

So it's a category of product, nothing more. And it's nothing new, either. Products like *Fancy Font*, *Fontrix*, and other programs that maximized the dot matrix printer are not that different. The resolution has improved and image manipulation has been added. Combine this with the emergence of the desktop scanner and you have desktop publishing.

What I'm waiting for now is for some sharp Japanese company to recognize the fact that the scanner, laser printer, and copying machine can be combined into a **laser-printer-photocopier-scanner-fax-machine all in one box**. Sell me one for \$995, please!

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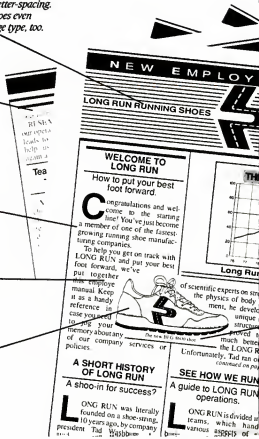
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Advantage Premium gives AT users, like Bill, all the power and flexibility they need. Maybe that's why PC Magazine selected it as Editor's Choice for AT multi-function boards."

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# BOB STANTON HAD A GREAT IDEA. AN HOUR LATER HE WAS TESTING IT.

Appointments. Everybody takes them — dentists, auto-body shops, dance instructors. And lots of computer applications need appointment screens.

Bob thought that a calendar made a terrific graphic metaphor for taking appointments. Simply use the arrow keys to pick an open date, then press the Enter key, and up pops an appointment window.

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With CLARION's Screener utility, he painted a white calendar on a black background. Then he drew a white-on-blue track around the page and between the days. He typed in the days of the week — and *voila!* — a calendar!

CLARION knows that a PC monitor is refreshed from memory, so it treats a screen layout like a group of variables. Just move data to a screen variable, and it shows up on the monitor.

Bob set up dimensioned screen variables for the days of the month and a screen pointer for selecting a date, and he was done. Then Screener generated the code.

Then Bob drew the appointments window, built an appointment file, filled in the connecting code and tested it — **ONE HOUR AFTER HE STARTED!**

Testing was a breeze. Screener doesn't just write code, it compiles your source, displays a screen, gets the changes, then replaces the old code in your program.

So here are Bob's appointment screens. You can see the source listing to the right. We marked all the code Screener wrote for him.



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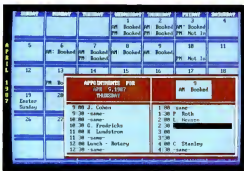
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CIRCLE 152 ON READER SERVICE CARD



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■ PETER NORTON

# WRESTLING WITH THE LASERJET PLUS



*Taming Hewlett-Packard's Laserjet printers is a challenge that has clear rewards. Norton details his exploits and, on the following pages, Jim Seymour reveals a few other solutions.*

As regular readers of this column already know, I'm a big fan of the Hewlett-Packard Laserjet printer, especially when *Microsoft Word* is driving it. The near-typeset-quality documents you can get out of this combination are really terrific. I do all my best-quality correspondence on it and, until recently, was using it to typeset my software manuals too. (For that I've now moved up to the Apple LaserWriter—a more expensive step that many people would not want to take.)

I've had some ups and downs with the Laserjet, experiences that I thought would be worth sharing with you. If you have, or are thinking of getting, a Laserjet, you can avoid my mishaps and go straight to the successes.

The original Laserjet had only a limited graphics capability and could get its fonts only from plug-in cartridges. But when the fancier Laserjet Plus model appeared, it added more graphics and the ability to take downloaded "soft" fonts.

I thought that would be terrific, and so I upgraded my Laserjet to a Plus. But in the end I was disappointed by it, and, for many people, I wouldn't recommend it.

My main disappointment was in how clumsy the soft fonts were to use. I expected that the procedure was simply to start the day by turning on the machine and downloading the fonts for a day's worth of use. (Downloading fonts, by the way, is painfully slow for the serial-port version of the Laserjet; with a parallel port it's much quicker, but hardly instantaneous.) Under the right circumstances that may do the job

for you, but I found that the programs I used with the Laserjet would either ignore the soft fonts I'd loaded, insisting on using a cartridge, or worse, clear my soft fonts out and download their own, doing it again and again each time I printed.

The result was that I found that soft fonts were so impractical and time-consuming to use that I avoided them, except for the few times I just really had to have their benefit.

That's not what we look for in a tool. We want good tools to enrich our lives and work all the time, not tools that we have to fight with to make work. On that basis, while I do highly recommend the basic Laserjet, for most people's everyday work I don't recommend the more expensive Plus version.

**RECOMMENDED** On the other hand, in my most recent adventure with the Laserjet, I've uncovered a way to get good

typeset-quality printing and to beef up the variety of things you can do on the printer. It's the new "Z" font cartridge (also known as the Microsoft I cartridge), developed by Microsoft and Hewlett-Packard together.

If your software can take advantage of the Z cartridge, you're in for a real treat. The Z cartridge takes everything I've liked about the old F cartridge and goes several steps further. With the Times Roman font you get the full set of roman, italic, and boldface variations for both 10 point and 12 point; ditto for the Helvetica face. That makes both Times and Helvetica really usable for the first time.

All too often, when it comes to computing, every shiny red apple (and Apple) comes with a worm in it. In the case of the Z cartridge, the worm surfaces in the way *Microsoft Word* chooses to use the cartridge.

For reasons that have more to do with benefits to come than with current use, the Z cartridge has two variations on its type fonts. One is the familiar ASCII and the other is something new to Laserjet cartridges called ECMA. ECMA has one flaw that I find hideous—instead of giving us nice typeset-quality single-quote characters, it has an extremely ugly version of them.

If you're not into typeset-quality laser printing, this might sound like no big deal, but the whole point of using a laser printer with good fonts is to get a result that looks as good as a printed book. One of the nuances of quality printing is the use of the two single-quote characters (the forward



## ■ PETER NORTON

and backward single quotes, also called the apostrophe and reverse apostrophe). If you decide to double up these characters instead of sticking with the double-quote character, you can manage to produce a

professional-looking set of quotes.

That is, except when you're using the ECMA symbol set—which *Microsoft Word* chose to use, much to my chagrin. (I did figure out how to get it the way I want

it, though; you can find the gritty details at the end of this column.)

In spite of that annoyance, the Z cartridge is a delight, both because of its selection of fonts and sizes and because Microsoft and Hewlett-Packard have finally gotten the letter spacing right.

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CIRCLE 523 ON READER SERVICE CARD

**OUT WITH THE BAD AIR** One of the things that's been an ongoing source of amusement and frustration is the mystery of why Hewlett-Packard has so much trouble taking the air out of its fonts. "Air" is the unnecessary blank space that intrudes between characters on a line. Too much air—or "fat"—spaces out the letters in a word and makes the typesetting appear clumsy and unprofessional. In subtle ways, it also slows down our reading, because to the eye it separates letters into individual visual units instead of packing them into complete words.

If having too much air is a kind of fat, HP's original proportional-spaced font cartridge for the Laserjet, the "B" cartridge, was grossly flabby. In fact, the B cartridge's spacing was so terribly messed up that Hewlett-Packard had to replace it with an equivalent, but tighter spaced, "F" cartridge.

Unfortunately, two tries weren't enough. Although the F cartridge was a lot better than the B cartridge, it still had too much air in it.

Finally, on the third try, HP and Microsoft got it right with the new "Microsoft I" cartridge. While the real purpose of the MS-I cartridge is to give a better selection of typefaces and point sizes, just getting the spacing right is enough to make it worthwhile to rush out and buy this new cartridge for your Laserjet.

[See *First Looks*, page 33, for a review of Hewlett-Packard's latest Laserjet printer. And, on the following pages, Jim Seymour details his own adventures and some different ways to tame the testy HP printers.—Ed.]

**TECHNICAL DETAILS** For anyone who wants to do it, here is how to modify *Microsoft Word's* printer driver to use the ASCII symbols, with their proper quotes. To do this, we'll be using the MAKEPRD tool that comes with *Microsoft Word*; it translates printer definition files (PRDs) in

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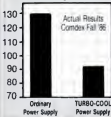
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## ■ PETER NORTON

and out of editable text format.

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The first change we'll make is to search and replace the code that selects the ECMA symbols (11Q), replacing it with the code for the ASCII symbols (0U). That'll give us the look we want for the quote symbols. That's an easy change to make, and it will give us the look we want, but it doesn't inform *Word* that we've changed the width of the characters—so when *Word* goes to figure out how much space has been taken up, the calculations will be wrong. For paragraphs that are justified left and right, it's crucial that the spacing be exactly right.

**YOUR TABLE IS WAITING** To fix that, we have to change the tables that define the proportional spacing of each type font. Fortunately, that's easy to do. If you browse through the printer file, you'll find that some tables are full of entries like "32:65". These numbers define the width for each character; the first number, 32 in our example, is the ASCII character code, while the second number, 65, is the character width.

There are quite a few width tables in the printer file, one for each type style and point size. In each table we change the width definition for both of the single-quote characters. But how do we know what width to make these characters? The answer is simple—since they're just like a comma, we give them the same width as a comma.

So, for each space table, we first scan for the comma entry—which we find by looking for "44:"—and note what its width number is; then, in the same table, we find the two quote entries ("39:" and "96:") and change their widths.

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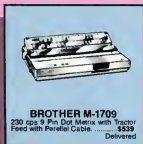
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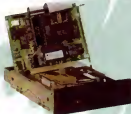
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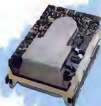
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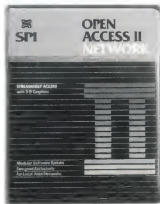


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■ JIM SEYMOUR

# THE AGONY AND THE ECSTASY OF SOFT FONTS



*Downloadable fonts can be more trouble than they're worth. There are a few ways to make your laser printer shine, but more solutions are in order.*

**C**hoose one:  
 • The versatility and professionally typeset appearance provided by downloadable (soft) fonts is one of the best things about laser printers.

• The frustration and agony of wrestling with downloadable fonts is one of the worst things about laser printers.

My answer: both.

As a former (and occasionally still active) graphic designer, I worry a great deal about how items printed on my laser printer look. And having worked with type for 25 years, I appreciate and enjoy working with subtle differences in typefaces, sizes, and weights.

So when I first stuck that ubiquitous "B" font cartridge in a plain-vanilla HP Laserjet a few years ago, and out came good genuine Times Roman and absolutely awful fake Helvetica, I was in love.

There are a lot of limits to what you can do with the very few sizes and faces in that cartridge, though, so I was charmed once again a year or so ago when Hewlett-Packard released its first package of soft fonts—typefaces reduced to bit images, then stored on disk, to be downloaded to RAM in the printer just before the print job is run.

By then I'd moved up to a Laserjet Plus—a good thing, since the original Laserjet hasn't got enough RAM to do much serious work. The first soft fonts HP released were good-looking, subsequent releases even better. Now that HP's working with Bitstream, which understands both how type ought to look and also the tricky job of designing fonts to look good in 300-

by 300-dot-per-inch resolution, the HP faces look great.

All this has been a lot of fun, and my reports and correspondence look much better than before. I've done a wide range of printed pieces wholly on the laser, preparing camera-ready copy for programs, brochures, postcards, quick-and-dirty letterheads, and more. Indeed, downloadable fonts are becoming so widely used that we're seeing "letter quality" redefined in many cases to mean much more than just clean 10-cpi Courier with a little microjustification thrown in.

My correspondence now goes out in 12-point Times Roman, for example, "set" with one point of leading and with 3.6-point "slugs" between paragraphs. Boldface and italic type have taken the place of underlining—always an ugly convention and a primitive way of indicating emphasis.

However and ahem . . .



The agony of downloading typefaces to the printer, and the difficulty of selecting the typefaces themselves within documents, often outweigh the ecstasy of how good the printed page looks.

Most vendors of these soft fonts provide some way to stick 'em in the printer's memory. HP has a primitive little beast of a program, *PCLPak*, for example, which theoretically makes managing the selection, downloading, and subsequent use of soft fonts easy. In practice, it makes it a pain in the ass. But don't dump on HP: *PCLPak* is probably the best font-downloader available from a soft-font vendor.

**WORD'S THE ONE** The truth is, managing downloadable fonts has to be handled from within the applications program if the fonts are going to be usable.

One program, *Microsoft Word*, is exemplary in this respect. *Word* comes with printer-driver files that include full descriptions of each typeface, size, and weight in the HP soft-font sets. From within *Word*, I just choose the right driver, then I can turn parts of my text into 24-point bold Helvetica or 10-point Times Roman italic exactly as I would change from 10-cpi Courier italic to 10-cpi Courier bold. Nice job, Microsoft.

Other programs do well also. Xerox's *Ventura Publisher*, which grows on me daily, does an OK job with downloadable fonts. *WordPerfect* does pretty well. Beyond that, it's nearly hopeless.

But what a burden this is for these few enlightened vendors of word processing, desktop publishing, and other applications



## ■ JIM SEYMOUR

software: every time a font vendor releases a new font package, these software shops have to write and somehow distribute the appropriate new printer driver.

It's clear that burden will be—and

ought to be—passed on to the typeface sellers. In fact, in support of Bitstream's latest (superb) soft-font packages, which offer Century Schoolbook, Garamond, and Optima faces, Hewlett-Packard has

written printer drivers for *Microsoft Word*.

Though the HP/Bitstream fonts are the best I've seen, other good downloadable fonts are becoming available. VS Software is shipping such useful (and otherwise unavailable) "real" typefaces as Gill Sans, Antique Olive, and Friz Quadrata.

Bill Overman's SoftCraft, which introduced a lot of PC owners to the idea of good-looking type with the *Fancy Font* series, sells decent typefaces on disk. And Conographic previewed some very good-

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■ Though the HP/Bitstream fonts are the best I've seen, other good downloadable fonts are becoming available.

looking and reasonably priced soft-font packages for lasers at last November's Comdex—though I haven't been able to get my hands on the real thing yet.

**A LONG WAIT** My problem with all the soft-font packages is simple: the effort required to download and select their typefaces is out of proportion to the value those faces bring to the finished page.

There are other problems with soft fonts (for example, the 5- and 6-minute waits while the fonts are downloaded to the printer, and not being able to get enough typeface size and weight variations into the still-too-limited RAM of most desktop lasers) but none so severe as the fundamental problem of picking typefaces within a document, then getting the bit images of those faces into printer memory.

HP's new Laserjet Series II (see review on page 33) smooths some of these rough edges. It can accept two font cartridges and its control panel can select primary fonts. But that's not even half the battle.

Vendors, you'd better do whatever's necessary to make using those gorgeous typefaces a lot easier, or they're going to sit on the shelf. And an absolutely wonderful idea is going to die aborting.

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■ STEPHEN MANES

# THE ELECTRIC FOOT



*Do you think you've heard it all, that nothing could surprise you anymore? Before you answer, read this report from the outer reaches of athletic technology.*

All right, I confess. At times in this space I have varnished the truth. Now and then I have embroidered a bit. Okay: I've lied. I've made stuff up. I'm guilty!

So instead of honoring April Fool's Day with some clever fabrication, I've decided to go straight and tell the whole truth and nothing but (mostly). In this case, it's definitely stranger than fiction.

What computer peripheral boasts a "unique multi-saddle design for unparalleled support," "hollow-backed lugs that act as individual shock absorbers," "3M Scotchlite (tm) reflective trim for night safety," "a soft knit lining for comfort," "a three-density removable foot bed," and a \$199.95 price tag?

Answer: the Puma RS Computer shoe.

It's definitely a conversation piece. The conversation generally begins with, "What are those funny plastic wedges sticking out of the back of your shoes?" Make up your own witty retort; the honest answer is that the wedge on the right shoe is the housing for its electronics. The one on the left is a dummy included primarily in the interest of symmetry, though the literature claims that each housing "also acts as an external counterreinforcement for stability."

Stability? The housings extend about an inch behind the rear of the soles, causing them to catch unexpectedly on such uncommon objects as stairs and curbs. This particular design feature does not create significant problems during ascents, so you might be willing to wear the shoes when practicing for the Empire State

Building run-up. However, you will probably prefer to descend sideways, on tiptoe, or in the elevator, rather than risk taking a 102-floor header.

The shoes come with a pair of disks, a pair of cables, and a manual. One Y-shaped cable lets you share the shoes with your kid's Apple or Commodore. The IBM cable, emphatically not a Y-type, goes from the hole in the back of the shoe to . . . well, take a guess!

Wrong! Despite the shoe's "RS" moniker, it doesn't use the RS-232 port at all. Instead, in what may well be a PC first, you must use your PC's printer port as an input device. That's right: LPT1. The manufacturer is contemplating offering a Y-connector; until then, having to disconnect the printer and reconnect it after every run may well weed out those with insufficient athletic commitment.

The way the shoe itself works seems simple at first. While footless, it remains in



"sleep" mode to conserve power. Tapping the right heel "wakes" it into "test" mode, in which the shoe emits a beep at each impact.

When you're ready to run, you press a little red button and a little black button on the back of the shoe. When you're done, you press the black button again so that your running data remains stored in the shoe until you transfer it to your PC. (Woe betide you if you accidentally tap the red button when removing the shoe or inserting the cable into the covered jack right beside it; that resets the shoe to zero.) You can also use the computer to program a target distance into the shoe. When you've reached your goal, the shoe will beep at you six times.

Simple, right? Ready to hit the streets? Well, not quite. As the manual explains, the shoe "works on the principle that there is a relationship between the time for successive ground contacts of your foot and the speed at which you run," and it has to be calibrated to your specific running style. As the manual points out, "The procedure for doing this is very exact . . . until the data from the calibration runs has been entered into the program you will be unable to store or use data collected from your regular runs . . . you must enter at least 15 calibration runs performed over a period of 4 to 5 days in order to get accurate results."

Well, you can handle that; you'll just get out there and do it. Ah, but first you need the proper accessories, as indicated in the "What You Will Need for Your Calibration Runs" section: "a stopwatch and

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D1S

## ■ STEPHEN MANES

access to a 400-meter track, or a means of accurately measuring a 400-meter straight course." In my neighborhood, that's a tall order. The only 400-meter track in my neighborhood has razor wire around it to

keep out graffiti artists and computer columnists; when I went into the boulevard with my 400-meter tape measure, cars emerging from the cross streets snapped it in two.



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CIRCLE 367 ON READER SERVICE CARD

However, I did learn that "it is not necessary to wear the computer shoes to perform the calibration runs." You see, "to gather calibration data, you must run a 400-meter course at a series of steady speeds while keeping count of the number of contacts your right foot makes with the ground." No mistake: you've got to perform 15 runs while counting "one and two and three and . . ." The fastest and slowest runs must differ by at least 2.2 miles an hour; the shoes aren't sensitive enough to work for walkers.

And then you're still not done. The addendum to the manual demands an additional set of calibration runs. Just five this time—on a course at least 2 miles long. If you run on more than one type of surface, you must perform at least two of these secondary calibration runs on each surface. And of course, "it is crucial that the distance be measured accurately." After you've entered all the calibration data, you can finally get down to running. You can use the less-than-dazzling interpreted BASIC programs supplied to download your times and distances from the shoe, as well as to display them, your goals, and your caloric expenditures in numeric form and simple bar graphs. You can also type in a diary entry for your daily runs.

By this time you may reasonably wonder whether this isn't the sports world's equivalent of a checkbook-balancer. But Puma seems committed. When the shoe wears out, it will sell you another, minus the old one's removable electronic guts, for a mere 85 bucks. When the battery wears out (after 3 years of plugging and unplugging the cable), the guts will set you back 30 clams. A replacement cable is \$5. Considering that the replacements are cheaper than the originals, you wonder if Puma is considering copy protection.

According to the newsletter that comes with the shoe, "researchers at Cornell University are planning to strap shoe electronics on cattle, to help determine how far they range over a period of time." I can just picture some latter-day John Wayne herding bulls around the track for 15 calibration runs. The scene is completed as Lawrence Welk's hapless nephew steps gingerly behind them in newly bought computer shoes, counting "A-one and a-two . . ." I didn't make this up! Honest!



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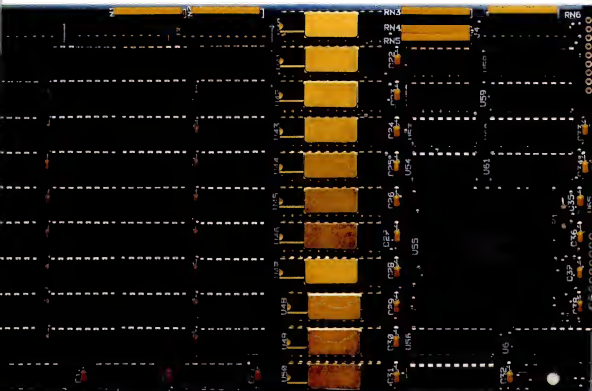
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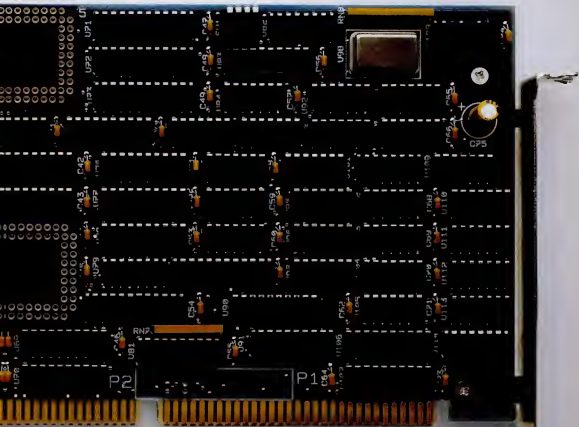
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## ■ STEWART ALSOP

# PET PEEVES

*Alsop had a few things he wanted to get off his chest. The idea seems to be contagious: PC Magazine's publisher, William Lohse, joins in with some thoughts of his own.*

Every once in a while in every columnist's life, there comes a time when no matter how hard he tries he just can't think of a good column.

Most columnists who have writer's block go to their mailboxes and start answering readers' mail. Nobody writes to me (just John C. Dvorak), so I decided to get into one of my favorite subjects: pet peeves. There are things that hardware and software companies do that just drive me insane. For instance, why is it so hard for computer companies to design the on-off switch onto the front panel of the computer? Are they scared that us dumb users are going to accidentally turn off the computer if it's too easy to turn it off?

And why is it so hard for software publishers to "preinstall" their manuals? Time after time, the first thing I have to do with a manual is tear off all the shrink wrapping, insert the tabbed dividers in the right place, and then put the pages into a three-ring binder. I'd rather . . .

We interrupt this column for a message from the publisher.

**Publisher's note:** Replace Stewart Alsop's picture over his column with mine and put my name at the top.

What do you mean I can't do that? It's my magazine, and I can take over Alsop's column if I want to.

In case you missed it last fortnight, Stewart Alsop, the normal denizen of this space, said basically three things: that publishers are strange folk because their job is to have a magazine that attracts the kind of

readers to whom advertisers want to sell; that he agreed with the basis for this magazine—which is that you, the readers, know more about computers than your computer-using colleagues, and that because of your expertise they ask you what to buy and how to be productive; and that you, as experts, have a job as large as the industry's in trying to understand the needs of what Alsop calls the "poor dumb user" because the users will always get what they need whether or not we (the experts and the industry) give it to them.

**PRODUCTIVE INNOVATION** I want to make it clear that my role as a publisher is not to worry about whether the editors are writing to the kind of readers the advertisers want to sell to. My role is to work with the staff at *PC Magazine* to figure out who is deciding which innovations are really productive and useful or not. We've decided that the best bet is to go with those

people who are knowledgeable enough about products to be trusted to vote with their company's dollars. So we are producing a magazine that prides itself on its understanding of and ability to evaluate personal computer products, a magazine that specifically serves the needs of the better-informed technical gurus inside American business.

It's our job to deliver the goods: hands-on testing by a real laboratory; the best analysts and thinkers we can find; editors who live with the technology like you do; comparative testing because you have to choose from amongst a plethora of similar products; productivity sections to make what you've already bought more useful; and lots of opportunities for you to interact with us through our reader columns.

You've responded by buying *PC Magazine*. Our circulation has skyrocketed to over 375,000—by far the largest in the PC-compatible market—and we see no signs of slowing down.

**TALKING TO THE INDUSTRY** So our next job is to represent you to the industry.

You are an opinionated lot because you have to be. You have work to do, and the PC industry needs to listen to you. When they do, they often also buy advertising space with us. Ads let the industry tell their story directly to you and let us keep doing our job.

I completely agree with the other two points that Alsop made in the last issue. Not everyone who uses a PC can keep up with the fast pace of changes, and if you don't help these users make useful and pro-



## ■ STEWART ALSOP

ductive selections the PC industry will suffer and you'll eventually have a different job. And I'm sure that after this lucid dissertation, Alsop will agree with me regarding the publisher's role. He wants to keep

writing this column. Right, Stewart?

We now return this column to its author.

See, what did I tell you. Publishers are a

little strange. Taking over my column to explain what *PC Magazine* really does and then threatening my job. What gall!

**BRING BACK THE MAC** I've just spent a fascinating week here in the San Francisco area. First of all I read a Reuters' report in *The San Francisco Examiner* which said that IBM is cutting prices on its PCs (this is early in January) in order to clear out its inventory so that it can introduce a new model of the basic PC. This report implied that IBM is introducing new computers in part because Apple Computer (yes, that's right: Apple) is giving it trouble—that's an original idea.

Then I go to the Macworld Expo (featuring the Apple Macintosh) in the city and see that every one of the big software publishers—all companies that made their money in the PC-DOS world—are introducing and selling new programs for the Mac because all of a sudden corporations are buying a machine that absolutely everybody said they would never buy.

And then I come home that night to see that my own editor, Bill Machrone, has written an editorial praising certain aspects of the Macintosh (see From the Editor's Screen, Volume 1 Number 2). And to top it off, I get my weekly issue of *Business Week*, with its cover heralding "Apple's Comeback" and a story that admits that, yes, it was a bit early to write the company off in the corporate world.

Whatever you might personally think of the Macintosh computer, the point is that corporations are now buying the machine because some users (yes, the poor dumb ones mentioned earlier) decided that they would find the machine more useful than IBM PCs or compatibles in certain situations. By and large, they had to force their companies (and their technical gurus) to buy the machines.

The only point I want to get across is that, whatever products we're talking about—new machines or new peripherals and software for existing machines—the people who ultimately decide where personal computers are going are the people who have to use the stuff. And everybody else—the technical gurus (that's you), the industry's vendors, and even the columnists and magazine publishers—had better not forget that simple fact.

## DIREC-LINK

Now there is a software solution that handles copying files between your PC and Lap-Top—**SIMPLY**. No clumsy setups, no long strings of commands, no modems, no external drives to buy. Just connect the serial ports, run Direc-Link on both machines, select the files to be copied, and go!

First, Direc-Link displays a complete tree diagram of the directories of each PC. Point to a directory and tag the files you want to send, then select where you want to send them—hard disk or floppy. You can tag any number of files from a directory—using a variety of tagging commands. The received files are faithful **COPIES**, including the original creation date and time, without the extra characters some modem programs add!

Your **FILES** are copied fast, over 10,000 characters per/sec (115,200 baud), and you can control the whole process from either keyboard. Direc-Link requires a minimum of keystrokes—simply point and shoot. If you have files that you send back

and forth regularly, you can store the entire sequence in command files that execute with a single keystroke. The program comes with both 3½" and 5¼" disks so you can install Direc-Link on your PC, your laptop, your portable, or any PC compatible.

Now you're ready to copy any number of files **BETWEEN PC's** and lap-tops! You can customize Direc-Link for color or monochrome displays, and change the communications parameters. Cable wiring diagrams are included and you can order cables directly from us. Only \$59.50 plus \$5.00 shipping. California residents add sales tax.

**MICRO-Z** NOT COPY PROTECTED!  
To order call 213-377-1640  
Company (est. 1967)

4 Santa Bella Road, Rolling Hills Estates, CA 90274

System Requirements: IBM PC, XT, AT, or compatible, serial port, DOS 2.0 or later and 80 column display. Requires less than 64K RAM.

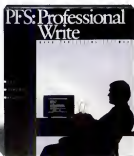
CIRCLE 113 ON READER SERVICE CARD

PC MAGAZINE ■ APRIL 14, 1987



Dealer inquiries invited

# Even the best programs can be improved.





PC Mouse

Microsoft Mouse

*A mechanical mouse has moving parts that make it less reliable, less accurate, and so dirty it actually needs a good cleaning now and then. PC Mouse has no such parts or problems.*

Saving this much money on software this good could easily make your day. But put that savings together with our new PC Mouse, and you've got a deal (actually you've got six of them), that's tough to pass up.

Our new PC Mouse makes even the best programs better. Easier to work with. Quicker to get around in. But besides that, it's also the best mouse going.

What makes PC Mouse so good?

For one thing, it has no moving parts. And that means no problems.

PC Mouse is optical. It uses a mirror-like pad to reflect a tiny beam of light. So it's faster, more accurate and so reliable it's the only mouse with a lifetime warranty.\*

In addition to this specially-priced software, PC Mouse also works with any software program

written for use with a mouse. And quite a few that aren't. Just use our Designer Pop-up™ menus, to create your own mouse-driven software. It's included free.

When you order, make sure you specify PC Mouse in either the serial version or, for \$20 more, the new Bus Plus model

which includes its own serial card.

Either way, you're getting the best of all possible worlds.

The best programs and the best mouse. Now, all at the best price.

CIRCLE 350 ON READER SERVICE CARD

Call 1-800-523-5189

Or, fill out this coupon and send to: Mouse Systems, Dept. 10, 2600 San Tomas Expwy., Santa Clara, CA 95051

I want to order this software and... **PC Mouse** or **Bus Plus**

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| <input type="checkbox"/> Harvard Professional Publisher™ | <input type="checkbox"/> \$599 | or | <input type="checkbox"/> \$619 |
| <input type="checkbox"/> First Choice™                   | <input type="checkbox"/> \$199 | or | <input type="checkbox"/> \$219 |
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| <input type="checkbox"/> Desq View™                      | <input type="checkbox"/> \$179 | or | <input type="checkbox"/> \$199 |
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Or send check or money order made payable to:  
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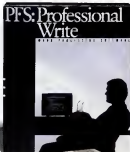
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# With our mouse and these prices.



\$189



\$219



\$299



\$179



\$199



\$599





**THE MIGENT POCKET MODEM. A STATE-OF-THE-**

It's ironic. These days, modems bring the world to you at the speed of light. But for all their awesome speed and power, these high-performance machines just sit there on your desk like a low-tech toaster.

But now, we're introducing the Migent Pocket Modem. It's 100% Hayes-compatible, so it works with virtually any PC: IBM, Apple, or whatever. It runs at both 300 and 1200 bps. It has a full set of Hayes AT commands. A 28-character non-volatile memory. Remote ring and tone sensing. Busy and dial tone monitoring. And even dual phone jacks.

But that's where all similarities end. The whole modem is smaller than a 3" x 5" card and works on a 9 volt battery or AC power. So you can put it in your shirt pocket or briefcase, and take it home, on the road, or anywhere else you need your PC.

The Migent Pocket Modem. If you'd like to know more, send in this coupon or call **800-633-3444**, Dept. 602, and ask for Alexis. We'll send you full information and the name of your nearest dealer. But in the meantime, you may be wondering why this modem isn't beige like the rest. Because we think it's about time a high-powered information machine looked like one.

CIRCLE 34 ON READER SERVICE CARD

☐ Please send me more information about the Migent Pocket Modem. And send me the name of the dealer in my area.

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**ART INFORMATION MACHINE THAT LOOKS LIKE ONE.**

# For The Few Businesses That Didn't Buy A Toshiba Printer, We Put On A New Front.



P351

Our best-selling P351 dot matrix printer has a new front panel that puts the controls in easy reach.

No more straining for the dip-switch or shuffling through software. Now you change the pitch or change a font with just a fingertip.

Then sit back as the P351 rifles out draft jobs at 300cps. Or letter-quality work at 100cps in more than 40 different type styles, all available on both downloadable disks and plug-in cartridges. With a printhead proven to last up to two times longer than most other 24-pin printers.

It's also IBM PC<sup>1</sup>-compatible, emulates IBM Graphics and Qume Sprint 11<sup>2</sup>, and runs just about every major software package you could want it to.

And if it's color graphics you need,

the P351C will turn a bright idea into a brilliant presentation. It gives you all the features of the P351 and puts high-resolution color graphics on paper for printed reports, or on transparencies for overhead projection.

All of which may explain why there are more Toshiba printers serving more businesses than any other 24-pin dot matrix printer in America.<sup>3</sup>

To find out why your business should be using Toshiba printers call (800) 457-7777 for the Toshiba printer and computer dealer near you.



P351C

1 IBM and IBM PC are registered trademarks of International Business Machines Corporation.  
2 Qume Sprint 11 is a registered trademark of Qume Corporation. 3 Installed base figures from Datquest.

In Touch with Tomorrow

## TOSHIBA

Toshiba America, Inc., Information Systems Division

# HIGH- SPEED ATs

## Life in the Fast Lane

Did you spend your Clearasil years listening to the Beach Boys and Jan & Dean sing odes to Mustangs, GTOs, and little deuce coupes? Reading muscle car magazines with pictures of fiberglass hood scoops, small-block Chevy engines, and Hurst shifters? If so, you should feel a wave of nostalgia with the advent of the ultra-high-speed 12- and 16-MHz AT clones that are the PC industry's version of the hot rod: fast, not for everyone, reliability sometimes a question mark, but ever so desirable (especially if you have backup transportation).

When the IBM PC AT rolled into dealer showrooms in 1984, the mainstream machine was the reigning speed champ. The 80286 processor running at 6 MHz and a 40-millisecond hard disk drive made the 8088-based, 4.77-MHz PC-XT and its 85- to 110-millisecond hard disk

*If you live for the feel of a high-performance vehicle, check out our review of those new custom jobs, the 12- and 16-MHz ATs. But be warned—all is not fun in the sun.*

## ■ HIGH-SPEED ATs

drive look like a little Nash Rambler.

We all know what happened next. Speed freaks discovered that you could bolt a faster clock crystal into the AT, and it would go faster. Users inserted 16- and 20-MHz crystals (crystal rate is twice the processor rate) to get 8- and 10-MHz ATs and watched their spreadsheet recalculation times plummet. An unamused IBM slipped a speed governor into the BIOS to keep ATs from running faster than 6 MHz, watched Compaq and others unleash 8 MHz machines that ran with rock-steady reliability, then joined the horsepower race in mid-1986 with an 8-MHz machine. Did IBM satisfy the speed demons? Hardly—it set off a performance war.

Today, you need not stop at 8 or even 10 MHz for your AT clock speed. There are a number of 12-MHz and 12.5-MHz machines from which to choose, and you may even be able to hit the dizzy heights of 16 MHz, with either 80286 or 80386 processors.

We brought four of these high-speed 80286 machines into PC Labs: one each from Wells American and Computer Classifieds; two from PC's Limited. We ran them through their paces and compared them to Compaq's Deskpro 386. With the 80386 machines getting so much attention from both the press and the public these days, it is important to know the alternatives if you are seeking bang for the buck as well as processing power. Also important: quality of design and construction, and possible problems that might arise using these souped-up machines (see the sidebars "Hurry Up and Wait" and "A Fast Two or a Slow Three?").

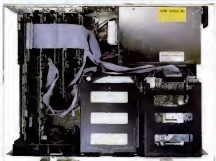
If you expect the machines to be pretty much the same (after all, how much can you do to an AT to make it different?), read on. Each had unique characteristics.

### COMPUTER CLASSIFIEDS INC.

#### CCIST/286-12

The standard configuration of Computer Classifieds' CCI ST/286-12 is 10 MHz, but you can upgrade it to 12.5 MHz, which was the configuration we received. In fact, CCI's family of PCs allows everything ranging from an AT in a PC box to a 386 in the AT box.

The CCI ST/286-12 comes in a standard AT-sized box that accepts up to five



The CCI ST/286-12's motherboard is unique for two reasons: it was designed to fit into an IBM PC-XT case (for an easy upgrade) and it has no CPU. The 80286 comes on a separate add-in board. You can see it in the photograph—two slots away from the power supply.

half-height peripherals. Ours came with a 1.2-megabyte floppy disk, a 72-megabyte hard disk, and a tape backup unit (the tape unit was not tested). When you open the top, you quickly discover that something is quite different with this machine: the motherboard has no CPU.

Instead, the 80286 chip comes on a separate board that fits in the slot second from the power supply. The first slot holds a 640K-byte memory card of proprietary design. You can tell that most memory cards probably won't fit; the mounting bracket turns to the left instead of to the right as on all other PC boards.

The separate CPU card is evidence of the most basic design difference about the

ST/286-12. It was developed from the ground up to be a 386 machine, but in recognition of many people's wait-and-see attitude about the new machines, CCI made a 286 configuration available. As a result, the two right-hand slots have 32-bit bus capability built in. If you want, you can send them your 286 board and \$800, and they will send a replacement board with the 386. (For a First Looks review of the 386 version, see "CCI ST/386 Brings Mail-Order Prices to 32-Bit Computing," Volume 6 Number 3.)

Besides the clock speed and CPU, the ST/286-12 offers you other options to play with. If you want to add a math coprocessor to speed up calculations, you can in-

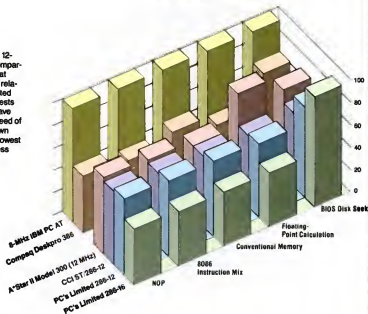


## Benchmark Tests: High-Speed ATs

While differences among the various 12-MHz machines are nominal, the comparison to the standard IBM PC AT running at 8 MHz suggests their true potential. The relatively slow performance by the PC's Limited 286-16 for the BIOS Disk Seek test suggests an improperly matched drive (the interleave factor is the most likely culprit) for the speed of the system. If you are configuring your own system, be sure to set your drive for the lowest interleave that produces the fastest access times.

### Relative Times

(Ratio: 8-MHz IBM PC AT = 100)



### Performance Times

(Times given in seconds except where noted.)

	NOP	8086 Instruction Mix	Conventional Memory	Floating-Point Calculation	BIOS Disk Seek (milliseconds)
8-MHz IBM PC AT	4.17	6.96	1.32	35.60	37.19
Compaq Deskpro 386	2.09	4.23	0.72	15.50	27.03
A*Star II Model 300 (12 MHz)	2.80	5.88	0.82	32.12	28.62
CCI ST/286-12	2.80	5.72	0.82	22.25	24.23
PC's Limited 286-12	2.80	5.88	0.88	23.18	30.35
PC's Limited 286-16	2.09	4.34	0.64	17.25	36.42

The NOP benchmark test is designed to measure raw clock speed and memory access time while minimizing differences in microprocessors and the effect of memory caching. This test executes almost nothing but NOP ("No Operation") machine code instructions in a big 100K loop.

The 8086 Instruction Mix benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 8086 instruction code. These instructions are a subset of the total processor instruction set.

The Conventional Memory benchmark test allocates 256K bytes of conventional memory and treats it as a series of 64-byte records. Then, 16,384 random records are read into and written from this memory. The result shown is the average of the read and write times.

The Floating-Point Calculation benchmark test measures processor speed by looping through a series of floating-point calculations, including multiplication, division, exponentiation, and logarithmic and trigonometric functions. The benchmark program uses the floating-point library included with Microsoft C Compiler 4.0.

The BIOS Disk Seek benchmark test measures the time it takes to do a random seek using the disk's ROM BIOS. The test result includes minimal software overhead and may not parallel the manufacturer's claimed average access time. The test program performs 1,000 seeks. The average result is shown in milliseconds.



## ■ HIGH-SPEED ATs

stall your own crystal and oscillator chip, which are readily and inexpensively available. This way, you can run your 80287 at 6, 8, or 10 MHz, depending on your choice.

Moving in the other direction, you can also get the computer with considerably fewer components. CCI designed the motherboard to fit an IBM PC-XT case, so you can turn your 8088 machine into a 286 hot rod for \$1,439 (or \$1,139 for the standard 10-MHz speed).

The machine itself was a solid performer in all PC Labs benchmark tests. It consistently ran about one-third faster than an 8-MHz AT, and 4 to 13 times faster than the standard PC. The 25-millisecond Toshiba hard disk also kept things moving along at a rapid pace.

The ST/286-12's construction is generally solid, but has some pluses and minuses in its design. On the plus side, you'll find cutouts in the back of the chassis de-

■ You don't need to fish around for a diagnostics utility disk with the CCI ST/286-12, since all the diagnostics are available in ROM.

signed to accept the extra port connectors that hang off many expansion cards. Also, a small heat sink that surrounds the 80286 chip should help extend the reliability and life span of the CPU.

On the other hand, the Western Digital floppy/hard disk controller seemed to be too close to the CPU card when we mounted it in the third slot from the right. During testing, the cards were removed and replaced a number of times, and the floppy disk drive cable apparently got nicked and damaged by one of the sharp points from some component sticking through the CPU board. Once we replaced the cable and moved the controller to another of the 16-bit slots for the rest of the testing, there were no further problems.

However, the ST/286-12's 101-key "new AT"-style keyboard was the least desirable among those tested. The Taiwanese import suffered from a mushy feel and had almost no tactile feedback. I made lots of typing errors by inadvertently hitting adjacent keys. CCI may know something we don't know, however: the keyboard differed from the latest IBM standard by the appearance of a little key labeled "Macro" on the lower left-hand corner.

You don't need to fish around for a diagnostics utility disk with the ST/286-12, since all the diagnostics are available in ROM. You also access the Setup functions through this same facility, so it is easy to reconfigure your system as needed.

Perhaps the most comforting aspect of the machine is that it's overengineered as a 286 computer. Since the motherboard must be able to work with the higher demands of a 386, all components are rated

for 14.2 MHz or better. This rating gives you an extra margin of confidence when running a 12.5-MHz 286.

CCI contends the ST/286-12 should have fewer problems with expansion boards than many of its 12-MHz competitors. While many expansion boards perform unreliably at speeds above 8 MHz, CCI engineers selectively shortened only certain timing signals so as to render sensitive boards more comfortable at the higher speeds without a major sacrifice in overall performance.

### PC's LIMITED

#### PC's Limited 286-12 PC's Limited 286-16

In the quest for raw power, one machine reigns supreme in the 80286 market, leaving the others in a trail of smoke—or possibly vapor.

The PC's Limited 286-16 is rated at an eye-popping 16 MHz. But don't get too excited about the machine—it seems to be scarce. However, if you are willing to settle for merely fast, PC's Limited also has a 12-MHz machine (and, for \$400 less, a 10-MHz variant).

We requested and received a production model of the 286-16 to test in PC Labs, as well as the 286-12. People at PC Magazine have seen more than one of these machines—which make *Microsoft Windows* and *Word* jump—but not many more. I made a blind call in January to the PC's Limited sales line and asked to place an order for one of the machines. The sales representative was polite but brief: none were available, he wouldn't take an order for one, he didn't know when one would be available, and he suggested that I call back in a month. Other people have reported similar experiences since the first reports of the new machine appeared in late 1986.

There is some question about just how many 16-MHz 80286 processor chips are being produced, since only a single source (AMD, an Intel licensee) makes chips rated at that speed. It may well be that the 286-16 will be in short supply for quite a long time, so be prepared to lower your sights to one of the 12-MHz machines instead. [PC's Limited CEO Michael Dell confirmed that chip availability is holding



### FACT FILE

#### CCI ST/286-12

Computer Classifieds Inc.

17830 State Rd. 9

Miami, FL 33162

(305) 651-5853

List Price: \$2,395 for keyboard, case, 640K

RAM, floppy/hard disk controller, 1.2-

Mbyte floppy disk drive, 12.5-MHz 80286

CPU card, 10-MHz version, \$1,495. 16-

MHz 80386 version, \$3,195. 80286-to-

80386 CPU board exchange, \$800. 12.5-

MHz CPU board replacement for existing

PC-XT, \$1,439. 10-MHz replacement

board, \$1,139. 16- and 32-Mbyte RAM

card, \$880. 12-Mbyte 16- and 32-bit RAM

card, \$1,300. EGA board with one parallel

and two serial ports, 256K RAM of printer

buffer with RGB output and composite out-

put in color and black and white, \$695. Com-

bined hard/floppy disk controller to support

standard 506 disk interface and SCSI in-

terface, \$285. 40-Mbyte hard disk drive, \$799.

72-Mbyte hard disk drive, \$1,699. 60-Mbyte

tape backup, \$850.

In Short: A 12.5-MHz AT with the CPU on

a slot, not on the motherboard, so you can

upgrade to a 386 version later. Common design

with the 386 version suggests a measure of

reliability for the 286 version. Also

available in a 10-MHz version, or as an up-

grade to an existing PC-XT. Poor keyboard.

CIRCLE 88 ON READER SERVICE CARD



*PC's Limited 286-12 saves you desk space with its compact case that is 2½ inches narrower than the average AT-style case. The drive bay comes equipped with metal slides instead of the usual plastic. This should make for better grounding and reduction of RF emissions.*



*PC's Limited 286-16 is equipped with a SmartVu display panel, although at 16 MHz it's sometimes too fast to read. This band of LEDs, located on the front of the computer, alternately reports clock speed and the drive or directory you're logged onto.*

*back the 286-16 and said it may be several months—possibly late summer—before the 286-16 is out in quantity.—Ed.]*

The 286-16 and 286-12 have solid, compact cases with an internal support between the front and back panels for added strength. The case is 2½ inches narrower (left to right) than the average AT-style

case, which can help you make the most of precious desk space. The single drive bay has space for three half-height storage units, and they come with metal slides instead of the usual plastic. I found these a little harder to work with, perhaps due to some roughness on the edges of the stamped metal drive mount case, but I ex-

pect that the design pays dividends in terms of better grounding and reduction of RF emissions.

The PC's Limited machines also have their unique "SmartVU" display panel on the front. This little band of red LEDs that light in succession are driven by the timer interrupt; they let you know the system

# VARROOMMMM

## ONLY ORCHID GIVES YOU SO MANY WAYS TO TURBOCHARGE PC ENGINES.

Sooner or later, your PC will run out of gas. Even XT's and AT's can't make the grade with today's power-draining applications. Like complex spreadsheets, CAD, color graphics, account postings and large data bases.

But now there's a cost-effective way to supercharge your PC's engine: the Orchid family of turbos. They're easy to install, so you can sit back and enjoy smooth acceleration. Right past the AT - and even some new 386 machines.

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### ORCHID'S TURBO FAMILY.

	TinyTurbo 286	PCturbo 286e-12	Jet 386
Host Computer	PC, XT	PC, XT, AT	AT
Reference Speed	3 x XT	8 x XT	3 x AT
Accelerator Type	Replaces 80286	Coprocessor	Replaces 80286
CPU	8 MHz 80286	12 MHz 80286	16 MHz 80386
RAM	8K Cache	1 or 2 MB EMS	64 K Cache

### INSIST ON COMPATIBILITY ACROSS THE BOARD.

Orchid's accelerator cards give you the best compatibility in the industry. So you protect your existing investment, and extend your computer's

useful life. While avoiding the headaches of learning a new system - not to mention the cost of buying one.

### GET THE EDITOR'S CHOICE: TinyTurbo 286.

Shift into high gear. Get a great card at a great price - the crowd-pleasing TinyTurbo 286. It supercharges your XT to run *three times faster* than before. Yet it's so small it takes up only half a slot in your computer. Just two reasons why PC Magazine named it the Editor's Choice.

TinyTurbo 286 gives you a high level of compatibility that lets you run software like Lotus and Windows at AT speed with EGA graphics, EMS memory, or networking cards. You can even go back to your PC's regular 8088 chip, which remains in the system, giving you 100% hardware compatibility.

### ADD AWESOME PERFORMANCE: PCturbo 286e.

The front runner today in the accelerator stock card race for power users is clearly the PCturbo 286e: It revs up to 8 times faster than an XT or up to 2.5 times AT speed. Giving you - among other things - the world's fastest screen I/O. Plus the PCturbo 286e comes factory equipped with 1 Megabyte of fast RAM, expandable to 2.

PCturbo 286e is a powerful tool for developers and systems integrators. Through its advanced design, it lets you build minicomputer-like performance into standard PCs. With features like an optional 10-MHz 80287 math chip, and coprocessing software for concurrent foreground/background tasks.

### MOVE YOUR AT UP TO 386 HORSEPOWER NOW: Jet 386.

Take a look today at the price/performance leader in desktop com-

puting: the Jet 386. Depending on the application, it's up to three times faster than an AT. And twice as fast as some high-performance minicomputers. Yet you don't have to buy an expensive 386-based computer to get this kind of horsepower.

More importantly, Jet 386 uses the next generation technology, the 80386 microprocessor. So you can run all of the current software for the AT now, and all the new 386 software. By adding a Jet 386 to your AT today, you can extend the life of your investment well into the future. For a fraction of the cost.

The screenshot shows a spreadsheet application with a grid of data. The columns are labeled: Name, Age, Sex, Height, Weight, and several unlabeled columns with numerical data. The rows contain individual records, likely representing people's physical attributes and other metrics.

Large spreadsheet macros recalculate with lightning speed.

### WE ARE NUMBER ONE AND WE STARTED IT ALL.

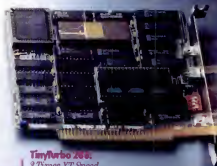
We introduced the first turbo for PCs, and now the first high-performance turbo family. Accelerators from Orchid deliver years of trouble-free operation. Add to that a long track record of supporting our products in the field, and you'll know why Orchid has become the number one supplier of accelerators for PCs.

For details on our full line of accelerators, graphics, networks and multifunction cards, contact your local dealer or Orchid Technology, 45365 Northport Loop West, Fremont, CA 94538; (415) 490-8586; TLX 709289.

CIRCLE 306 ON READER SERVICE CARD

TurboTurbo 286, PCturbo 286e and Jet 386 are trademarks of Orchid Technology. All other product names are trademarks of their manufacturers.

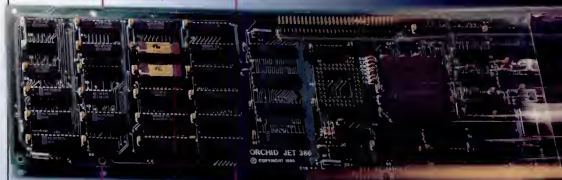
# 0000MM



**TinyTurbo 286:**  
*3 Times XT Speed*



**PCTurbo 286:**  
*8 Times XT Speed*



**Jet 386:**  
*3 Times AT Speed*

3 x AT

8 x XT

3 x XT



## HURRY UP AND WAIT

*The peripheral equipment and software that you already own (and hope to use) and your new, faster computer may not be compatible.*

**L**ife in the fast lane is not all it's geared up to be. Your selection of any computer operating above the 8-MHz "standard" level of the IBM AT should be a choice of careful consideration. Although the PC may be happy at that speed, some of the interface boards and add-ons you need may not keep pace.

Take, for example, Tall Tree Systems' J laser board, a major labor-saving device in page composition. *PC Paintbrush* or *Vennura Publisher* can use the J laser's on-board RAM to compose a printed image before it's sent to the printer. The construction and final output of a full-page graphic may take 4 to 5 minutes in the J laser's RAM instead of 20 minutes if a laser printer does the job alone. But install that board in a 12-MHz PC's Limited computer, press Ctrl-Alt-Backspace to kick in 12 MHz, and your screen will show naught but error messages.

The J laser is by no means atypical. Memory and video boards with 150-nanosecond or slower-rated RAM chips, such as an old EGA board, work fine in your 4.77-MHz PC or 6-MHz AT. Their architecture and chip speed allow them to puff along well at those low speeds, but give them the electronic equivalent of a hefty dose of adrenalin and they become psychotic. For 10-, 12- or 16-MHz use, you might find yourself completely renovating a RAM board with new 120- or 100-nanosecond RAM chips (lower numbers equal higher performance).

Conversely, I've run an Intel Above Board AT with 150-nanosecond chips at 16 MHz and found no problems. Intel rates them for 8-MHz service and "has had some good luck running them at 10 MHz," according to an Intel representative. But while any one board might work, Intel says a sample of 20 Above Board ATs would probably produce erratic results beyond 10 MHz.

And wouldn't it be just great if you could speed up recalculations on your 1-2-3 spreadsheet? Version 2 will access an 80287 math coprocessor. That, combined with a higher operating speed, should spell relief from those 20-second recalculation delays. However, if the 80287 is not (at least) a 10-MHz-capable device (such as an 80287-5 or, better still, for 16-MHz use an 80287-10), and you kick in turbo mode for 10-, 12- or 16-MHz operation, you'll notice an infinitely longer delay—as your computer freezes. And it will.

You'll need to match your coprocessor with your personal computer. Most manufacturers have designed their machines to run the 80287 at two-thirds of the system speed. Therefore, an 80287-3 (5 MHz) and an 80287-6 (6 MHz) will work fine through 8 MHz. The 80287-8 (8 MHz) should work up to 12 MHz. And the 80287-10 is at borderline tolerance for a 16-MHz computer (given the validity of the two-thirds rule). The free-with-this-coupon 80287 that Intel currently advertises with its Above Boards is

rated a -6 for 8 MHz and slower use.

Interface boards are prime candidates for disaster. While serial boards and internal modems worked well through the gamut, 3Com Ethernet boards that operated correctly at 10 MHz had seizures at 12 or 16 MHz. Those speeds were beyond the design tolerance for the version of the Ethernet board tested. Upgrading your server for faster speeds would likely include the expense of updating its network interface board as well.

Some boards fail on 12- and 16-MHz machines because the PCs use non IBM-standard bus timing. The PC's Limited machines, for example, double the DMA (direct memory access) rate from 4 to 8 MHz. Data moves around inside the machine twice as fast, but pushes some DMA-based add-on boards beyond their intended design limits.

(And if you were happy that most software copy protection has been dropped, don't ignore the fact that network security schemes can fall apart when placed in faster operating environments than those in which they were developed.)

None of this makes high-speed microcomputers impractical—just more expensive and occasionally more frustrating than you might have thought. When you switched from a 4.77-MHz PC up to a 6- or 8-MHz AT, you could use the boards you already owned to fill out the system. Now that you've crossed the 8-MHz speed threshold, you are starting over from square one. —Bill O'Brien

hasn't crashed when you encounter long delays. I was immediately reminded of the Cylon warriors from "Battlestar Galactica."

Part 2 of the SmartVU panel is an alphanumeric display reminiscent of a Times Square signboard that reports, at various times, what drive or directory you are logged onto, or the clock speed (on the

286-16 you can toggle between 16 and 8 MHz; on the 286-12, between 12 and 6 MHz). It also passes along many other bits of information, which are explained in the manual. I found that with the 16-MHz model, the display changed so rapidly that in many cases I couldn't read much of the content. Still, as a diagnostic tool and educational assist, SmartVU is hard to beat.

The 16-MHz performance is hard to beat, too. In almost every benchmark test, the processor ran at least twice as fast as an 8-MHz IBM AT—which may be expected, since the clock speed is twice as fast. This comparison is so easy to state that its impact may be lost. Let's put it differently: a standard IBM PC will take a full minute to execute instructions that a 286-16 can

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And RamFont is so flexible, you can even mix graphics on the same screen as text.

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## Lotus® 1-2-3®

By using RamFont to display smaller-than-standard characters, 1-2-3 Release 2 gives you a spreadsheet that shows almost twice as much data as before.

And, RamFont makes scrolling instantaneous and smooth, rather than painfully slow and jerky.

You can even view a graph in a pop-up window—another RamFont first.

## Microsoft® Word 3.

Word 3 was the first PC word processor that let you see boldface, italics, subscripts and superscripts mixed with regular text.

But it was slow.

Not anymore.

With RamFont, Word 3 runs almost four times faster.

## Lotus Manuscript.™

Manuscript is Lotus' new technical word processor, written to run optimally on the Hercules Graphics Card Plus.

It uses the RamFont mode for fast, multiple-font text editing.

Then it switches to graphics mode to format a page for printing, showing proportionally spaced equations.

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Besides these dramatic improvements, RamFont also dramatically improves the scrolling speeds of Symphony® 1.1 and Framework II.™

For WordStar®, there's a RamFont add-on that lets you use multiple fonts.

There's even a new word processor that lets you write in Greek, Russian and Hebrew, on the same screen.

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## And now, the really good part.

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(and later)  
Lotus Symphony Version 1.1  
Lotus Manuscript  
Microsoft Word 3.1  
includes mouse support  
Ashton-Tate Framework II  
Nota Bene™  
PS™  
Computer Linguist

For a complete list, contact Hercules.

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Suggested Retail Price.

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John C. Dvorak,  
PC Magazine columnist.

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Address: Hercules, 2540 Ninth Street, Berkeley, CA 94710. Ph: 415 540-6000. Telex: 754063. Trademarks/Owners: Hercules, RamFont/Hercules; Lotus, 1-2-3, Manuscript, Symphony/Lotus; Microsoft/Microsoft; Framework/Ashton-Tate; WordStar/MicroPro; AutoCAD/AutoCAD; Pagemaker/Adobe; Note Bene/Dragonfly; PS/Scal Systems.

CIRCLE 142 ON READER SERVICE CARD

## ■ HIGH-SPEED ATs

perform in just 8 seconds or less.

The one slow spot was extended memory. The motherboard came with a full megabyte of RAM, and the PC Labs benchmark test showed that the extended portion performed no faster than that of a 12-MHz machine. Perhaps design limitations force it to slow down, if you can call running 1.6 times faster than an 8-MHz AT slow. The 12-MHz unit performed on a par with the other two 12-MHz machines tested.

The units tested came with a 40-megabyte Seagate hard disk drive and a JVC 1.2-megabyte floppy disk drive, both supported by a single Western Digital control-

■ **The SmartVu display lets you know the system hasn't crashed when you encounter long delays.**

ler. The only other card provided was a PC's Limited EGA board, based on the ubiquitous Chips & Technologies chipset. Of the eight expansion slots, two were 8-

bit, the rest were 16-bit. There were no I/O ports on the motherboard, and none were provided with the test unit.

The keyboard had the 84-key "old AT" layout (a 101-key model may be an option by spring); it was made by the Maxi-Switch Co. PC's Limited swears by Maxi-Switch, but I found that it had a very hard touch, and I had to consciously press each key to make it register. I made many typing errors by dropping characters because I hadn't pressed hard enough. *PC Magazine* has experienced a number of keyboard failures and broken keys—not an epidemic, but enough to raise questions.



### High-Speed ATs: Summary of Features

(In ascending price order of configuration tested)

	A* STAR Model 399 Wells American	PC's Limited 286-12 PC's Limited	CCI ST/286-12 Computer Classifieds Inc.	PC's Limited 286-16 PC's Limited
<b>Base price</b>	\$2,690	\$2,695	\$2,395	\$2,995
<b>BASE PRICE INCLUDES</b>				
<b>RAM</b>	1 Mbyte	1 Mbyte	640K	1 Mbyte
<b>Floppy disk drives</b>	One—1.2 Mbytes	One—1.2 Mbytes	One—1.2 Mbytes	One—1.2 Mbytes
<b>Hard disk drives</b>	One—30 Mbytes	None	None	None
<b>Clock/calendar</b>	●	●	○	○
<b>Software</b>	None	None	None	None
<b>Monitor</b>	None	None	None	None
<b>Ports</b>	2 serial, 1 parallel, 1 game	None	None	None
<b>Slots</b>	8	8	8	8
<b>Power supply (watts)</b>	220	200	192	200
<b>Reset key</b>	●	○	○	○
<b>Keyboard style</b>	Old AT	Old AT	New AT	Old AT
<b>CONFIGURATION TESTED</b>				
<b>Price of configuration tested</b>	\$2,890	\$3,663	\$3,689	\$3,963
<b>Configuration tested</b>	12-MHz option, monochrome monitor, monochrome/graphics card	30-Mbyte hard disk drive, EGA card	40-Mbyte hard disk drive, Vega 7 Deluxe EGA card	30-Mbyte hard disk drive, EGA card
<b>SPECIFICATIONS</b>				
<b>Clock speed (MHz)</b>	6, 8, 10, and 12	12	12.5 and 6	16
<b>Controller card handles</b>	2 hard, 2 floppy disk drives	2 hard, 2 floppy disk drives	2 hard, 2 floppy disk drives	2 hard, 2 floppy disk drives
<b>IBM EGA compatible</b>	●	●	●	●
<b>Above Board compatible</b>	●	○	●	○
<b>OTHER</b>				
<b>Warranty</b>	90 days (31-day money-back guarantee)	1 year (30-day money-back guarantee)	1 year, parts and labor	1 year (30-day money-back guarantee)
<b>BIOS manufacturer</b>	Wells American W2 079L	PC Ltd. 9/18/85	Pro 286/386 Version 3.0	PC Ltd. 9/18/86

●—Yes ○—No



# FEATURES STANDARD WITH US, OTHERS DON'T EVEN OFFER AS OPTIONS.



Take our ARC Turbo 12,  
for example.

Take its speed. The fastest  
off-the-shelf AT™ compati-  
ble you can buy. (12.5 MHz,  
50% faster than IBM™)

Take the ARC Turbo 12's  
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which gives you a digital  
read out of the actual  
number of millions

of instructions per second  
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industry. Each  
unit also comes

with 90 days of Free on-site  
service. And our technical  
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CIRCLE 527 ON READER SERVICE CARD

## ■ HIGH-SPEED ATs



### FACT FILE

PC's Limited 286-16

PC's Limited 286-12

PC's Limited

1611 Headway Circle, Bldg. 3

Austin, TX 78754

(512) 330-6000

List Price: \$2,995 and \$2,695 for 16 and 12

MHz, respectively, with 1 Mbyte RAM, 1.2-

Mbyte floppy disk drive, case, keyboard.

286-10 (10-MHz version), \$2,295. EGAAd+

card, \$269. Mini I/O with one parallel and

one serial port, \$99. Enhanced AST board

with one parallel and one serial port, \$629

(for 12-MHz version only), Seagate 30-, 40-,

and 80-Mbyte hard disk drives, \$699, \$819,

\$1,495. Tandon 20-Mbyte hard disk drive,

\$329. 360K RAM floppy disk drive, \$89

Wang Tech 60-Mbyte tape backup, \$795.

Hercules-compatible video board, \$159. Intel

80287-8 math coprocessor, \$395. Internal

1,200-hps modem in short card, \$159. Internal

2,400-hps modem regular-sized card,

\$295. Monochrome monitor, \$129. EGA

monitor, \$479.

**In Short:** A nice piece of goods if you can

get one. The 286-16 is the contender for 286

speed champion and equals Compaq's Desk-

pro 386 for speed on many benchmarks. But

is it real or vapor? The easily available 286-

12 provides a measure of speed beyond 8-

MHz ATs. As with the others, keyboard

quality doesn't match IBM's or Compaq's.

CIRCLE 663 FOR READER SERVICE CARD

The internal design of the machine shows much of the same care that went into the case. The 80286 has a heat sink that looks like a tower of serrated disks. Does it make a difference? I don't know, but it looks more substantial and feels cooler than the smaller heat sinks on the other machines.

#### WELLS AMERICAN

### A\*STAR II Model 300

The A\*STAR II Model 300 boasts versatility of a different sort. The basic model (\$2,295 with a 30-megabyte hard disk drive and 1.2-megabyte floppy disk drive) has a top speed of 10 MHz, but you can get a 12-MHz upgrade for \$395 extra. With the 12-MHz option, you have six different CPU speeds from which to choose: 6 MHz with one wait state, 6 MHz with no wait states, 8 MHz with one wait state, 8 MHz with no wait states, 10 MHz, and 12 MHz.

■ You must run a special utility program from DOS that shows you what the A\*STAR's current speed is and permits you to select a different speed; you don't have to reboot.

This range of choices raises two important questions: what are the differences between the various speeds, and why would you ever want so many choices?

To answer the first question, you need to understand the concept of "wait states." When the 80286 microprocessor makes a request for data from the computer's memory, most machines wait one clock cycle between receiving the request and actually getting the answer. This delay is referred to as one wait state, and it means that the computer effectively slows down to make certain that the memory has been refreshed before retrieving information. In a well-engineered design with quality components, it is possible to eliminate this pause, with the net effect of speeding up the apparent speed of the processor.

According to a representative from Wells American, a computer operating at 6 MHz with no wait states is approximately equal to one operating at 7 MHz. Hence the A\*STAR offers five successively faster options ranging from 6 to 10 MHz, plus 12 MHz if you choose the turbo option.

So why would you want this many choices? As discussed in the sidebar "Hurry Up and Wait," not all programs and expansion products can operate reliably at the frenetic speeds of 10 and 12 MHz. In these cases, you must step down the speed until you are sure that the various components aren't dropping stitches anymore. Given the smooth range of built-in speeds, you should be able to accommodate almost any combination of requirements.

However, the A\*STAR's speed setting

contains a puzzling design feature. Unlike the other machines reviewed here, you cannot set the processor speed using a combination of keystrokes, such as Ctrl-Alt-Backslash. Instead, you must run a special utility program from DOS that shows you what the current speed is and permits you to select a different speed; you don't have to reboot. According to a Wells American representative, this procedure was developed because of market research. Researchers found that different keystroke combinations caused conflicts with some programs: Apparently, lots of programs picked the same odd combinations of keystrokes that "nobody else would ever use." Wells American also discovered that people tended to select a single speed and then leave it there for all their work. If you find the speed-switching utility too much of a constraint, Wells American does make it easier to take the risk: the company offers a 30-day money-back guarantee.

Another unusual feature of the machine is an auto-boot code in its BIOS ROM that lets you use the A\*STAR as a diskless workstation (\$995 and \$1,395 for 10 and 12 MHz, respectively) on a network. To



### FACT FILE

A\*STAR Model 300 with 12-MHz option

Wells American

3243 Sunset Blvd.,

West Columbia, SC 29169

(803) 796-7800

List Price: \$2,690 for keyboard, case, 1

Mbyte RAM, floppy-hard disk controller,

multisport I/O card, 1.2-Mbyte floppy disk

drive, 30-Mbyte hard disk drive, 80286 CPU

with 12-MHz upgrade, 10-MHz version,

\$2,295. Diskless 12-, 10-MHz versions,

\$1,390 and \$995. 12-MHz option, \$395.

Hercules-compatible monochrome graphics

card, \$95. Monochrome display monitor,

\$105. 80287-8 math coprocessor, \$395.

80287-6 math coprocessor, \$245.

**In Short:** The A\*STAR offers six different

operating speeds between 6 and 12 MHz with

0 or 1 wait state, which should be enough to

satisfy the most fussy software or expansion

hardware. A base version runs at 6-10 MHz.

Special ROM allows auto-booting of diskless

versions running under a network. Best key-

board of the bunch.

CIRCLE 664 FOR READER SERVICE CARD

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752 x 410

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EGA Multi Res gives you the best of both worlds.

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## 25 KHz/400 Line Monitors

640 x 350

and full compatibility with the IBM® PC, XT and AT.

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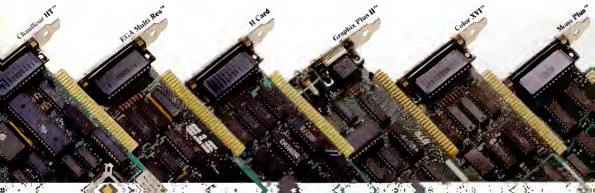
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CIRCLE 517 ON READER SERVICE CARD

\* STB includes drivers for Microsoft Windows with the resolutions of 640 x 480, 752 x 410 and 832 x 350.

\*\* CGA software that is compatible with the IBM Enhanced Graphics Adapter.

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## ■ HIGH-SPEED ATs

take advantage of the feature, you must buy the Wells American proprietary network software (\$395 per network) and an adapter card for each machine (\$395 each). Until recently, the A\*STAR cases included a BNC coaxial cable connector on the back, which was an artifact of an earlier network card design that required the motherboard to supply one of the connectors. The new cards supply both connectors, hence the one on the case has been discontinued. The network is not Novell *Network* compatible.

Like most AT-style computers, the A\*STAR has a battery backup for the CMOS RAM that stores the system configuration information. The other ma-

### ■ An auto-boot code in its BIOS ROM lets you use the A\*STAR as a diskless workstation on a network.

chines reviewed here had typical lithium batteries for this purpose. Lithium batteries have extremely long lives, but are a bit tough to find at the local drug store. Instead, the A\*STAR has a bank of four al-

kaline penlight batteries. They might not last as long, but at least you won't go crazy on a Saturday afternoon trying to get replacements when they wear out.

Aside from these points, the machine was fairly typical of its class. Besides having room for one full-height and three half-height storage devices, it came with a 30-megabyte Seagate hard disk drive and a 1.2-megabyte Teac floppy disk drive. The motherboard held a full megabyte of memory; a Western Digital combination floppy/hard disk controller, a monochrome graphics adapter with printer port, and an I/O card with two serial ports, a parallel port, and a game port were also supplied. Of the eight expansion slots, two were 8-bit and the rest 16-bit.

The keyboard had the 84-key "traditional" AT layout and offered the best feel of the machines tested. It had a medium amount of tactile responsiveness, and I found that I made the fewest typing errors



*Using the A\*STAR's utility program you can run the CPU at one of six speeds, ranging from 6 to 12 MHz. Typically, the battery backup for the CMOS RAM in the A\*STAR uses four alkaline penlight batteries; they won't last as long as the more usual lithium batteries.*



## PC EDITOR'S CHOICE

### Proceed with Caution

*Speed is a good thing. Safe, reliable, no-hassles speed is better still. None of the machines reviewed (the Wells American's A\*STAR Model 300 with 12-MHz option, the PC's Limited's 286-16 and 286-12, or Computer Classifieds' CCI ST/286-12) can be recommended across the board as everyday machines for all applications.*

*If you want speed, spread the risk around: either buy on a 30-day, no-questions-asked money-back trial and torture-test all your programs and add-on boards, or buy one of the machines that can be downgraded to 10 or 8 MHz, or consider a little less speed. We'll look at 10-MHz AT compatibles next issue.*

*The safest high-speed solution is also the quickest and the dearest. Withdraw \$6,500 from your bank account and order Compaq's 16-MHz Deskpro 386.*

# I Always TAKE TWO.



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PC MAGAZINE  
August, 1986  
"EDITOR'S CHOICE"

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## ■ HIGH-SPEED ATs

### A FAST TWO OR A SLOW THREE?

*Editor Bill Machrone outlines the pragmatic considerations in choosing a fast 286 machine over a 386 machine.*

**T**he latest issue confronting those who chase the ever-receding state of the art is whether they should buy ever-faster 80286 machines or make the jump to the 80386. The choices among 80386 machines are limited but growing daily. There are four considerations: performance, price, compatibility, and future software.

The 80386 machines we've tested clearly outperform all but the fastest 286 boxes. Machines like Compaq's Deskpro 386 and the ALR 386 are at the top of the heap. You pay more for a 386 machine, however. The premium over an equivalent 286 machine is about \$1,000 to \$1,500. Even with no other considerations, it may be worth that much to you just to run twice as fast as the run-of-the-mill 8-MHz 286.

Today's 80386 machines are designed as faster 286 machines. In Compaq's case especially, the designers have made

the bus as similar as possible to the PC AT. Some designers, such as PC's Limited, have sacrificed some compatibility for even more speed. This is not necessarily a bad thing; you just have to decide which is more important to you.

Future software is an issue, too. You'll be able to run 286 DOS on your fast 80286 machine, but never the Virtual-86 mode operating systems. Again, it comes down to what's most important: If you need to run multiple DOS 2/DOS 3 sessions, get the 386. If you're looking forward to the new generation of protected-mode software and don't give a hoot about existing DOS 3 applications, you can save money on a 286 now, but a 386 will run 286 DOS, too.

Finally, there's the very real possibility that IBM's new range of PCs will split the market into "oldbus" and "newbus" PCs.—Bill Machrone

with that keyboard. Since I am totally acclimated to the venerable IBM PC keyboard and that of the Leading Edge Model D, a best-selling PC compatible, I found the A\*STAR to have a slightly lighter touch than either of those two.

The motherboard appears to be well laid out and allows plenty of room for circulation: a flat heat sink covers the 80287 chip, which should help dissipate some of the heat it generates. If you are a total techie, you will appreciate a freebie coupon that comes with the computer; send it in and Wells American will send you a free set of schematics.

The machine performed about as expected. It was only slightly slower than the CCI ST/286-12 (which runs .5 MHz faster), but still was 23 to 38 percent faster than an 8-MHz AT. The hard disk was slightly slower, but still of sufficient speed to fit well with the hot-rod processor.

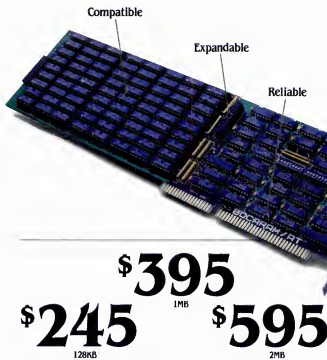
**CONCLUSION** Speed is addictive. Seeing *Microsoft Windows* and *Word* run at 12 and 16 MHz instead of on a 6- to 8-MHz AT or 4.77-MHz PC is the difference between a Porsche 944 turbo, a Volkswagen GTI, and a diesel Mercedes. They all get you there safely, but one is the way speed should be, one is adequately quick, and one is a pig.

Not every applications program and expansion board is ready to cope with speeds of 12 and 16 MHz, so we advise that you proceed with caution, especially if you deal with copy-protected software or other timing-critical applications. If you hunger for just a bit more speed, you should also consider the safer alternative: 10-MHz ATs. They'll be driven through PC Labs in the next issue.

*Alfred Poor is a frequent contributor to PC Magazine.*

# Unforgettable.

## BOCARAM /AT™



### Expand with the powerful new BOCARAM/AT™ and forget about memory problems.

It was only a matter of time before all those IBM PCs, XT's, AT's and compatibles had a memory lapse at 640KB. RAM got crammed with a widening world of multi-tasking, networking and LIM/Expanded Memory Specifications (EMS) software.

The industry once again looked to Boca Research. And for good reason. We've developed a reliable, flexible, cost-efficient solution. It's the BOCARAM/AT, a powerful add-on board which provides conventional, expanded and extended memory all on one board, in one slot. And you can expand the BOCARAM/AT up to a whopping 4MB! Compatible. If you have one of those beefed-up AT/compatibles racing along at 10MHz or better, guess what a "standard" 8MHz board will do? Right—power brakes. Not with BOCARAM/AT. It'll stay right up with your CPU, all the way to 24MHz. So you can keep the speed while using all your software.

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That's why we designed the BOCARAM/AT to take you to 640KB of conventional memory, and then up to 2MB of expanded memory or 4MB of extended memory—all on one card, in one slot! Don't need 4MB just yet? You can start with the basic card, and install additional memory later with standard RAM chips. Just that easy.

Reliable. Like all Boca Research products, the BOCARAM/AT is carefully tested before leaving the factory. Even unpopulated boards are tested with full memory before shipping. We don't expect to see these boards back, but if we do, our liberal 2-year warranty ensures you'll get quick service.

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# THE SCIENTIFIC PC

---

*Manufacturers  
of personal computer  
products are waking up to  
the importance of the  
scientific and technical  
market. New software  
products and accelerators  
are pushing PCs  
off of the desktop and  
into the lab.*

---

In those first heady days after the introduction of the IBM PC in August 1981, it wasn't at all clear just how the new machine would be used, or by whom. IBM never foresaw its widespread use in offices for word processing, for example. That fall, a worker in what came to be called the Entry Systems Division development group in Boca Raton dismissed the idea and at the same time apologized for the PC's screwball keyboard with a characteristically IBM "let 'em eat cake" line: "No, no. Anyone who wants to do word processing will buy the Displaywriter."

But among the earliest fans of the PC were scientists, mathematicians, and engineers who saw in the PC cheap, compact processing power. Some wanted it in order to escape the tyranny of "waiting for the VAX"—a common and unpopular fact of life in many universities, research centers and technical firms. Others hoped to be finally freed from the messy job of drawing complex mathematical formulas, molecular diagrams, and other graphical additions by hand into their manuscripts before sending them off to their publishers. And a

## ■ THE SCIENTIFIC PC

very large number of people doing lab work saw in the IBM PC a smart, if expensive, instrumentation controller and data-logger to help run, monitor, and analyze results from their experiments.

Efforts of third-party vendors to reach this potentially huge, if not very visible, market have been spotty. Now, though, PC software and hardware marketers have begun listening to the people in the labs, R&D centers, and ivory towers. Lotus Development Corp., having mopped up in the business/personal productivity market with *1-2-3* and *Symphony*, has introduced two new programs specifically focused on the scientific and technical market. Other vendors are circling warily, looking for market entry points.

**GOODBYE, ANALOG WORLD** Marty Alpert, the physician-researcher who founded Tecmar, one of the first third-party PC add-on product vendors, responded to that early interest in the PC among the scientific community with some of his first products: analog-to-digital signal conversion cards that remain standards in the industry today.

By inserting an analog-to-digital, or A/D conversion card, a lab worker can equip a PC to receive, record, and act upon a steady stream of signals from a piece of laboratory apparatus, many of which until recently did not provide digital output. On one level, that might be a simple job, such as logging the measurements of an instrument monitoring an experiment every 2 seconds for a week, much like a strip-chart recorder. On a more sophisticated level, the PC might simultaneously monitor a dozen different instrumentation outputs at different time intervals from an experiment and perhaps respond—in a servo-mechanism-like fashion—to some of those signals, sending instructions back to the instruments when certain values exceeded or dropped below anticipated normal ranges.

Indeed, in many labs PCs have become the up-to-date electronic equivalents of chart recorders. Because the data is saved directly into a magnetic record in computer-readable form, the time, expense, and errors associated with manually transferring data points from a strip chart into a computer are eliminated. Better still, with

the data in the computer, statistical analysis and graphical interpretation of results are readily available.

**MASSAGING DATA** It sounds perfect, and it is—almost. Tying together the instrumentation monitoring and the data analysis sides of the job has been tricky. Several PC software packages are available to help manage the job, and now Lotus has jumped into the fray with its new

■ The frustrations of trying to get most WP software, PC hardware, and printers to display and print complex formulas are immense.

*1-2-3* add-in, *Measure*. Because *1-2-3* has itself been such a hit in the lab for manipulating and analyzing data, Lotus built *Measure* as a bridge between the world of instrumentation and immediately readable *1-2-3* spreadsheet files. *Measure* "knows" all about the output characteristics of many popular lab instruments and can receive their signals in a variety of forms (RS-232C, IEEE 488, etc.). Since incoming data is written directly into a pre-formatted *1-2-3* spreadsheet, researchers are spared the need to wrestle with data importation through ASCII, DIF, or other file-exchange formats. Instead, they can move directly to analyzing the information through *1-2-3*'s mathematical, data-sorting, and graphing functions.

The development of *Measure* was itself a revealing process, and a sign of the growing importance that vendors attach to the scientific and technical market. *Measure* is the first product from Lotus's Engineering and Scientific Products Division, formed about 2 years ago. As useful as the program will be to laboratory workers, Lotus may never recover its substantial development costs. But Lotus sees the engineering and scientific market as so important to its

future that it was willing to underwrite the development of a potential loss leader to establish the credentials of the new division as a source—the source before long, some Lotus people say—of PC software tools designed for the special needs of technical professionals.

(A second, hidden-agenda reason for the *Measure* development effort was to show other developers how Lotus believes *1-2-3* add-ins should be written. As the first of what already has become a flood of new programs that load into RAM along with *1-2-3*—in effect grafting onto it and then working from inside it—*Measure* set a tough but illuminating standard for independent software houses that use the new Add-In Tools development package from Lotus to write add-in products for *1-2-3*.)

Although in the beginning the \$5,000 cost of PCs made them pricey lab controllers, the sharp decline in IBM and clone prices over the past 18 months has begun to make them look like very cheap devices even when permanently assigned, or dedicated, to controlling instruments.

Dr. Guy Bush, a professor of zoology at Michigan State University in East Lansing and a fan of the Macintosh, has three in his offices and labs for word processing and producing graphics. But he's just added a Zenith PC clone for monitoring experiments. "It only cost about \$1,200 with the hard disk," he says, "and it lets us instantly analyze the results." Bush is working with a complex, home-grown setup that monitors the electrophysiological responses made by the antennae of apple maggot flies to host-plant odors. "There's so much lab software already available for the PC," he says, "that, much as I like the graphics on the Mac, the PC makes a lot more sense for instrumentation monitoring. We just haven't got the time to write that software ourselves for the Mac."

**TECHNICAL WP** Some of those other early visions of PCs at work in scientific and technical applications have taken longer to live up to expectation. Scientific word processing is a good example. The frustrations of trying to get most WP software, PC hardware, and printers to accept, display, and correctly print complex formulas are immense. Mastering early, specialized products, such as *Volkswriter Sci-*

entific, proved even tougher than inking the figures in by hand on printed pages. Even more complex programs for printing formulas, such as the MicroTeX IBM PC implementation of Donald Knuth's widely used pseudotypesetting program, TeX, proved even more daunting, and so have been only occasionally used directly by the authors of books and technical papers.

Now *Manuscript*, yet another new program from Lotus, promises relief (for a review, see "Manuscript: A Technical Writer's Tool Kit"). With a simple and logical system for typing in those complex formulas, blinding speed, and a number of tools for organizing, formatting, and indexing long, structured documents, *Manuscript* is a product remarkably well suited to the needs of technical writers.

One of the most endearing aspects of *Manuscript* is its page preview feature. At any point in writing a document the author can pop into a graphics mode that shows correctly proportioned snapshots of how finished pages will look, using dummied or simulated type. A floating "magnifying glass" window can be moved over any part of the text, the degree of magnification varied up to 10X, and presto! *Manuscript* shows in that window exactly how those complex formulas (as well as standard text) will look on the finished page.

Other popular technical word processing programs include TCI Software Research's *T<sup>1</sup>* and *Proofwriter*. An important advantage of *Proofwriter*, from Image Processing Systems in Madison, Wisconsin, is that it works with either a special ROM character chip for non-graphics displays or with special downloadable character sets (supplied for the Hercules, EGA, and CGA graphics boards) to allow users to actually see on-screen the special characters they're typing. Various "international" character sets are available, too, mainly for word processing in languages other than English, but IPS's X3 character set, which includes all the requisite characters and symbols for scientific, math, and engineering, is the one to use for in-depth technical work.

**CRUNCHING NUMBERS** Running lab instruments and writing technical papers are important applications, but somehow both fall short of what we think of when someone

says "scientific computing." Visions of Fast Fourier Transforms, complex ANOVA statistics, and other serious math calculations dance in our heads when we hear that phrase—distracting us from keeping an eye on the cosmic stew bubbling in those beakers down the hall or writing an abstract. It's mainly in this area—the application of raw computing muscle—that PCs have found a mixed reception among scientists and mathematicians.



While programs are available for the PC that perform many of the same complex mathematical modeling, analysis, and forecasting jobs available on mainframes, the dimensions of the problems that can be reasonably undertaken on a PC and their speed of execution fall short of what you can do on the big iron. Thus, many scientists and mathematicians readily turn to their PCs for word processing and other supporting jobs but remain chary about moving their mainstream professional work onto desktop computers.

Dr. Peter John, professor of mathematics at the University of Texas at Austin, was an early adopter of the IBM PC but nonetheless prefers to run many programs on larger computers. "I have a very early PC at home, still two floppies, the old motherboard," he says, "and it complements the PC-XT on my desk at the University very well. I still use *WordStar*, because it does everything I need, and I know it. My earlier books, before the PC, were a form of agony, but no longer. I'm continually surprised by the advances in PC software. I can do things now with one or two keystrokes that once took 10 minutes."

John has PC versions of several pro-

grams that he already uses on the University's mainframes for his professional work. "But I don't use them on the PC, you see, because I prefer to work with them on the larger computers. I use my PC and my PC-XT as terminals into the University's DEC and Control Data Corp. mainframes, and into our VAX. I have *MiniTab*, a statistics program, in a version for the PC, but I don't use it; I use the version of *MiniTab* we have on the VAX. I have *StatPac* for the PC, but I don't use it. I have *GLIM*, or General Linear Models, from the Royal Society, for the PC, but we also have it on the CDC, where I prefer to use it.

"Just to run *GLIM* on the PC takes three floppy disks, which is an awfully large part of my XT's disk, and quite a lot of work on my two-floppy PC at home. But if I use *Smartcom* to turn that PC into a terminal, I have a much easier time of it with the program on the mainframe."

Often PC-based programs, while similar or even nearly identical to mainframe software, have limitations that limit or defeat their purpose for scientific use. Dr. G. Barrie Kitto, a New Zealand biochemist now working on cancer research in the United States, has become a PC buff and an expert on PC graphics programs in particular. "I'd love to have a powerful molecular-modeling graphics program I could run on my PC's Limited 286-12," he says. "But there isn't anything like that yet, so I do that work on our large Evans & Sutherland system."

"And I'd like to do presentation-quality graphs of the results of many of our experiments for reproduction, but most PC graphics packages won't accept nearly enough observations," Kitto explains. "These packages let you plot up to 40 or 50 points—in some cases even up to 200 or so—but I may have to plot and display 1,000 or more points, producing a very smooth curve. PC graphics programs won't let you do that yet."

## FLOORING THE ACCELERATOR

Whether PC programs will work as well as mainframe programs is often a matter of just how fast the PC can crank out the numbers. There is a perplexing trade-off for many scientific and engineering users: Is it quicker and more efficient to execute a program on a PC, which is right at your

# Get a Grip on Assembly Language.

The award winning Visible Computer: 8088.



The Visible Computer is a book and software combination for mastering the elusive skills of assembly language. PC Tech Journal took one look and made it their September '85 "Program of the Month."

It's an animated simulation of the PC's microprocessor that lets you see with your own eyes how assembly language works. You'll be using it as a debugging tool for years to come.

It's a tutorial. A lot of people think the 350 page manual is the best book on assembly language ever written.

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## ■ THE SCIENTIFIC PC

desk and always available, if not very fast, or to queue up to get the job onto the mini-computer or mainframe? At businesses, R&D centers, and educational institutions blessed with ample computing resources, leaving jobs on the big iron may make the most sense. But when mini or mainframe time is particularly hard to get—or when a perverse chargeback system makes it expensive—the slower execution of the PC begins to look pretty good.

Of course, speeding up a PC helps a lot, too. The newer 12-MHz and 16-MHz AT clones are very appealing in this sense, and the even faster 80386-based PCs may answer the great majority of execution time worries. But in the meantime, other answers are available. Adding a math coprocessor chip, such as Intel's 8087 and 80287, can make a huge difference with programs using a lot of exponentiation—if the program is smart enough to look for and use the math chip.

Pushing that math coprocessor chip to higher speeds helps, too. If your PC's 80286 CPU chip races along at 16 MHz but a companion 80287 math chip runs a lot slower, you're not getting nearly as much improvement in execution times as you thought you paid for. Hauppauge Computer Works' Fast-10 can bump the 287 up to 10 MHz; Ariel Corp.'s Xcelb can push it much further—to 12, 14, or even 16 MHz.

Plug-in array-processing cards are also a good answer—if you're a programmer or have access to programming talent in your shop. Similarly, if you can handle the programming required, hybrid add-ins that bring faster CPU chips (and supporting coprocessors) to the PC, such as National Semiconductor's wonderful 32032 and Motorola's 68020 speedster, can kick your PC into high gear. (For reviews of some of these products, see "Changing the Rules of the Game.")

**BESTING THE MAINFRAME** In some cases, though, PC-based programs do things that are not possible on mainframes. Typically, these involve using interactive tools that abandon the batch approach of many mainframe products. While they may not be able to handle really enormous jobs, the convenience and flexibility of these PC programs make them far more

useful for the busy researcher.

A fine example of such a program is *MathCAD*, a technical worker's electronic scratch pad (see article, "Software for Problem Solving"). *MathCAD* produces an enormous, "live" EGA-compatible graphics screen that is far larger than the PC's own display, which allows users to put whatever they want wherever they want, in almost any form they choose. It's not that *MathCAD* is better than other, similar products for bigger computers: the fact is that there are no programs like *MathCAD* on larger machines.

Rather than requiring formal input techniques and a structured way of working, *MathCAD* lets users throw an equation up on the screen, plug in the values, and get an immediate answer. Want to see a graph of the equation? Just carve out a little space somewhere on the screen and set up the graph. Need more space? No problem there. Your "virtual" screen, or electronic scratch pad, is huge: just scroll down or to the right and continue working. If this is a recurring calculation in your work, save the model—it's hard to use such a formal tool for such a wonderfully informal tool—and call it up again and again, inserting new values each time.

It's not only that *MathCAD's* approach is so well suited to the real-world daily needs of engineers, scientists, and mathematicians—it's that such an approach is literally impossible with terminals tied to mainframes, where constant shipping of high-resolution screenfuls of information back and forth between a display device and a processor at 9,600 bits per second would reduce the program's performance to a crawl.

We're likely to see many more of these interactive, unique-to-PC programs over the next couple of years as vendors discover what a rich, if demanding, PC market the scientific and technical community has become. In turn, development of those new and better tools, not available on larger computers, is likely to bring even the most skeptical members of the lab-coat set into the PC fold. And for lots more than just monitoring experiments and grinding out publications.

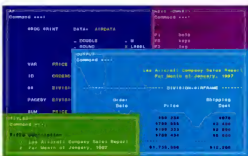
Jim Seymour is a contributing editor of PC Magazine.

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# Peachtree Complete Accounting for Just \$199

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When you reduce the price of an 8-package accounting system from \$4,800 (or \$600 a module) to \$199 for the complete set, people are bound to ask questions. Here are some of the most popular ones we're hearing at Peachtree:

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Peachtree has long been the first name in accounting software, so we've had time to completely amortize our original development costs plus make over 100 major additions. These enhancements include multi-company capability, menu driven installation and removal of copy protection. Consequently, you're getting a proven product at a better price.

We also "unbundled" support (so you only pay for what you need when calling our toll-free technical support hotline) and established a network of local dealers to serve as Independent Peachtree Support Centers.

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  - Accounts Payable
  - Inventory Control
  - Fixed Assets
  - Job Cost
  - Payroll
- 2. Installation Guide** to lead you step by step through our simple installation procedure.
- 3. Accounting Primer**, written for Peachtree users by an industry expert, to explain accounting concepts.
- 4. Tutorials** on each module with sample data to make learning easier.
- 5. A complete Reference Library** with detailed instructions in plain English on all software functions.

**Q.** Is Peachtree Complete really the same product that used to sell for \$600 per module?

**A.** Peachtree Complete is basically the same accounting system that both



Bill Goodwin, President of Peachtree Software

Peachtree and IBM sold for about \$5,000 but with substantial improvements in function and presentation.

Data files built with previous versions of the system are compatible, so many users are upgrading to Peachtree Complete to take advantage of the new features and benefits.

With more than 150,000 users to its credit, Peachtree Complete has been the PC World Class Winner in its category for two of the last three years.

**Q.** What's the difference between Peachtree Complete and the \$69.95 systems?

**A.** Peachtree's system is called Complete because it contains the eight most needed accounting packages (including payroll) and all reference materials for one price. Remember, it was designed as a \$4,800 accounting software system.

The \$69.95 systems, on the other hand, are incomplete. They were designed to sell for \$69.95 and require the purchase of additional modules to be comparable—payroll, \$49.95 more; tutorials, \$19.95 each; etc. Everything is a la carte.

**Q.** How soon will I outgrow the system?

**A.** Peachtree Complete handles revenues up to \$21,000,000, so only the largest companies will outgrow the system. The ability to process data for at least 50 individual companies is one of the system's biggest selling points.

The new optional multi-user module allows Peachtree Complete to be installed in a local Area Network, and Peachtree Data Query, for just \$199, lets you quickly transfer your accounting data to many popular spreadsheets

and databases, as well as produce custom reports.

**Q.** What if I'm not satisfied with Peachtree Complete?

**A.** When you purchase Peachtree Complete directly from Peachtree Software, you're protected with a 30-Day Money Back Guarantee (an option even the most expensive accounting products don't offer).

If you're not satisfied, simply return the complete product in saleable condition within 30 days and your purchase price will be promptly refunded. For full details on our support plan and money-back guarantee, call the toll-free telephone number below.

## PC Magazine Best of 1986

"Kudos to Peachtree, which woke up one morning and decided that its eight integrated accounting software modules, which the day before had sold for \$600 each, were at \$4,800 for the set, just a tad overpriced and so cut the price for the whole set down to \$199—a pretty good discount in anyone's league." —Jim Seymour, contributing editor of *PC Magazine*.

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- |  |   |
|--|---|
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Requires MS-DOS version 2.0 or higher with 128K of RAM. For use with the IBM PC, PC XT, PC AT and compatibles IBM is a registered trademark of International Business Machines.



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THE  
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# MANUSCRIPT:



## A TECHNICAL WRITER'S TOOL KIT

Technical writers have needs above and beyond those of other writers who use word processors. They often write long, highly structured documents, which include tables and equations, and revise them frequently. They need indexes and footnoting capabilities, as well as a spelling checker (which other writers often need, too). And they must tightly format their pages.

Usually, such capabilities are available on a piecemeal basis—one from one package, others from another (see sidebar "Scientific Word Processors: A Guide to the Competition"). But *Manuscript*, the new word processor from Lotus Development Corp., was designed as a tool kit, conveniently packaging all of these features together for technical writers. And the sheer breadth of features available will make this package useful for anyone who

*Lotus Development Corp.'s Manuscript handles tables, equations, and large documents with ease, but the program itself isn't that easy to use. It also lacks basic word processing features.*

## ■ THE SCIENTIFIC PC

writes and revises long documents.

But beware. If all you need is a simple word processor, you'll want to look elsewhere. Besides being overkill, *Manuscript* can be difficult to use and lacks some basic word processing features.

**STRUCTURED DOCUMENTS** One of *Manuscript's* most powerful tools is its structured editing mode that you use for long documents. This is basically an outliner that automatically numbers chapters or sections and creates a table of contents. The other mode of operation is an unstructured editing mode, which allows you to do the basic word processing functions and is recommended for short documents, such as memos. While the two modes use the same basic commands, only the structured mode includes the outlining capabilities.

You can use the structured editing mode in two ways. Super organized writers can outline a document and then use the parts of the outline as their section headings. Other writers can start writing, creating sections as they go along, and then display the corresponding outline at the touch of a button. A format menu gives you a choice of various styles of lettering or numbering for each section level. Your choices include Arabic or Roman numerals and letters.

At any point, you can collapse to the outline and reorganize it. When you move a section, all of the attached subsections will move with it. You can also change section levels, and when you do, the level of all of the subsections changes as well.

You can easily move to any section you wish by displaying the outline, moving the cursor to the section head, and then redisplaying the full text.

To give you an idea of how useful the *Manuscript* outliner is in a real-life situation, we initially analyzed separate aspects of *Manuscript*, each creating separate *Manuscript* documents. When it was time to consolidate the material, we transferred each other's work into a single structured document. Then we reorganized the material using *Manuscript's* outliner. Finally, we unnumbered the section heads and submitted the review. Without *Manuscript's* outliner, we would have been forced to use tedious multiple block moves and

**FACT FILE**



**Manuscript**  
Lotus Development  
Corp.  
55 Cambridge Pkwy.,  
Cambridge, MA 02142  
(800) 343-5414  
(617) 577-8500  
List Price: \$495

**Requires:** 512K RAM, graphics display for print preview, DOS 2.0 or later.  
**In Short:** *Manuscript* is a ground-breaking word processor designed specifically for editing massive technical documents. It features an outliner, a table editor, equation formatting, import of I-2-3 or Symphony worksheets, and import of graphic images. However, its user interface is surprisingly difficult, and some basic word processing features are missing. Recommended for those who require its special features. Not copy protected.

CIRCLE 82 ON READER SERVICE CARD

searches to achieve the same result.

But there are some limitations to structured documents. Structured and unstructured documents, like oil and water, can't mix. You can perform the alchemist's trick, changing an unstructured document into a structured one, but the reverse isn't possible. You might want to do the latter, for instance, if you want to include an outline for a proposed book (a structured document) into a book proposal letter (probably an unstructured document) that you are mailing to several publishers.

*Manuscript's* structured editing is overly rigid in several other areas. For example, you can't reset the numbering. If you are writing a document with five chapters and three appendixes, you would want to reset the level-one section numbering after chapter five so that the first appendix is numbered one, not six.

Another omission is that you can't change the format on a section-by-section basis. Using the example above, you might want to label your chapters with Arabic numerals but use Roman numerals for your appendixes. That's the sort of structure found in real documents, but it isn't allowed in a *Manuscript* document. Of course, you could fudge it by manually numbering your appendixes, but that's ex-

actly the burden that *Manuscript* should shoulder for you.

**HUGE DOCUMENTS** One of *Manuscript's* claims is that it will work with huge documents, up to 700 pages long. We tested that claim by feeding it the entire text of a 350-page book. The file was over 600K bytes long, or about 80,000 words.

Our first attempt to edit the file was aborted when *Manuscript* printed an error message that said it was out of virtual memory. Virtual memory refers to the extended memory or disk space *Manuscript* uses when it runs out of main memory. One megabyte of virtual memory wasn't enough to edit our 600K document. Using the convenient Setup option on the main menu, we told *Manuscript* to use up to 2 megabytes on our hard disk for virtual memory. Once we had reconfigured the program for larger virtual memory, it was able to handle our big file.

We found that, generally, you need twice as much virtual space as the size of the document you plan to edit. You should also plan to use real memory, not a disk for the virtual space. While a disk works, adequate hardware support will make your life much easier when you're working on huge documents. You can use your hard disk as backup space; for example, if you are short a few hundred K of extended memory, then *Manuscript* will go to the disk for the excess.

You also have the option of using extended memory or using space on a RAM-disk. *Manuscript* also supports the Lotus/Intel/Microsoft expanded memory specification.

Once the memory question was settled, we edited the book as a structured document, which is probably what most huge-document users would do. We replaced all of the book's existing section markers with *Manuscript* sections, and we were then instantly able to use the built-in outliner to rearrange the manuscript. We were able to move sections in seconds. Local operations, such as moving the cursor or inserting or deleting text, seemed unaffected by the large file size. As we paged through the document, our only clue that the document was huge was an occasional delay while the disk was accessed. Saving the entire book required about 45 seconds,



## SCIENTIFIC WORD PROCESSORS: A GUIDE TO THE COMPETITION

*Although Lotus's Manuscript is a powerful newcomer to the field of scientific word processing packages, it faces some stiff competition. Listed below are other scientific word processors vying for the leading edge in the marketplace.*

### **Brü Science**

Scientific Communications Corp.  
2135 Walnut St.  
Philadelphia, PA 19103  
(215) 732-7978  
**List Price:** \$395

**Requires:** 256K RAM, two disk drives, IBM CGA or EGA, Hercules (or compatible) color/graphics card, or monochrome/graphics card, DOS 2.1 or later.  
**Copy protected.**

CIRCLE 661 ON READER SERVICE CARD

### **MicroTeX**

**Version 1.5**  
Addison-Wesley Publishing Co. Inc.  
EMS Division  
One Jacob Way  
Reading, MA 01867  
(800) 447-2226  
(617) 944-3700

**List Price:** \$295; with preview and printer driver, \$745; with preview and Epson dot matrix printer driver, \$619.95.  
**Requires:** 512K RAM; two disk drives; IBM EGA or compatible; Hercules monochrome/graphics card; Techmar Graphics Master needed for preview driver; DOS 2.1 or later.

**Not copy protected.**

CIRCLE 660 ON READER SERVICE CARD

### **Proofwriter Color Graphics Version**

Image Processing Systems  
4414 Regent St.  
Madison, WI 53705  
(608) 233-5033  
**List Price:** \$425

**Requires:** 256K RAM (380K RAM recommended), two disk drives, IBM CGA or compatible, DOS 2.0 or later.  
**Copy protected.**

CIRCLE 679 ON READER SERVICE CARD

### **Proofwriter Enhanced Color Version**

Image Processing Systems  
4414 Regent St.  
Madison, WI 53705  
(608) 233-5033  
**List Price:** \$475

**Requires:** 256K RAM (380K RAM recommended), two disk drives, IBM EGA or compatible, DOS 2.0 or later.

**Copy protected.**

CIRCLE 678 ON READER SERVICE CARD

### **Proofwriter Hercules Graphics Version**

Image Processing Systems  
4414 Regent St.  
Madison, WI 53705  
(608) 233-5033  
**List Price:** \$425

**Requires:** 256K RAM (380K RAM recommended), two disk drives, Hercules or compatible monochrome/graphics card, DOS 2.0 or later.

**Copy protected.**

CIRCLE 677 ON READER SERVICE CARD

### **Proofwriter International/Scientific**

Image Processing Systems  
4414 Regent St.  
Madison, WI 53705  
(608) 233-5033  
**List Price:** \$300; PROM chip, \$125.

**Requires:** 256K RAM (380K RAM recommended), two disk drives, DOS 2.0 or later.

**Copy protected.**

CIRCLE 676 ON READER SERVICE CARD

### **Proofwriter Standard**

Image Processing Systems  
4414 Regent St.  
Madison, WI 53705  
(608) 233-5033  
**List Price:** \$250

**Requires:** 256K RAM (380K RAM recommended), two disk drives, DOS 2.0 or later.

**Copy protected.**

CIRCLE 675 ON READER SERVICE CARD

### **Proofwriter TurboFonts, Version 1.1**

Image Processing Systems  
4414 Regent St.  
Madison, WI 53705  
(608) 233-5033

**List Price:** \$149, plus \$4 shipping; optional PROM chip, \$75.

**Requires:** 30 to 50K RAM depending on printer, plus the RAM required by your word processing package; one disk drive; IBM EGA or compatible or Hercules Graphics Plus card if not using PROM chip; DOS 2.0 or later.

**Not copy protected.**

CIRCLE 674 ON READER SERVICE CARD

### **Spellbinder/Scientific, Version 6.03**

Lexisoft Inc.  
P.O. Box 1980  
Davis, CA 95617  
(916) 758-3630  
**List Price:** \$790

**Requires:** 256K RAM; one disk drive; IBM EGA, CGA, or compatible; Hercules or compatible monochrome/graphics card, DOS 1.0 or later.

**Copy protected.**

CIRCLE 673 ON READER SERVICE CARD

equation specifications on the left and the resultant output on the right.

**TABLES** The column feature lets you create complex tables. You can move, join, delete, box, set typefaces, center, left flush, or right flush the columns. These

columns also make it easy to format complex tables, such as the table in Figure 1. You can also use columns to create lists (the left column is for the list label, the right for the body of the list).

These columns, however, are not of the desktop publishing variety. While a desk-

top publishing package will allow text to flow automatically from one column to the next, *Manuscript* requires you to specify the text items that are to go next to each other in the two columns. Desktop publishing systems also allow you to wrap text around graphics; however, with *Manu-*

### TCI T3, Version 2.1

TCI Software Research Inc.  
1190-B Foster Rd.  
Las Cruces, NM 88001  
(505) 522-4600

List Price: \$595

Requires: 512K RAM (640K RAM recommended); two disk drives; IBM EGA, CGA, or compatible; Hercules or compatible monochrome/graphics card; DOS 2.1 or later.

Not copy protected.

CIRCLE 672 ON READER SERVICE CARD

### TechWriter

CMI Software  
1395 Main St.  
Waltham, MA 02154  
(617) 899-7244

List Price: \$395

Requires: 256K RAM; two disk drives; IBM EGA, CGA, or compatible; Hercules or compatible monochrome/graphics card; DOS 2.0 or later.

Not copy protected.

CIRCLE 676 ON READER SERVICE CARD

### VolksWriter Scientific

Lifetree Software Inc.  
411 Pacific St.  
Monterey, CA 93940  
(800) 543-3873  
(800) 831-8733 (in Calif.)

List Price: \$495

Requires: 256K RAM, two disk drives, IBM CGA or compatible, DOS 2.0 or later.

Not copy protected.

CIRCLE 676 ON READER SERVICE CARD

### WordWare Composer

WordWare Author  
MARC Software International Inc.  
260 Sheridan Ave.  
Palo Alto, CA 94306  
(800) 835-2400  
(415) 326-1971

List Price: WordWare Composer, \$199;

WordWare Author, \$119.

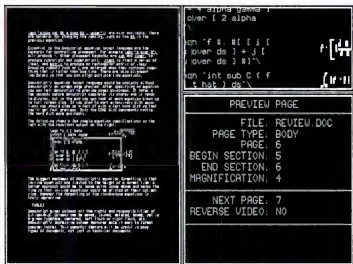
Requires: 512K RAM, hard disk, DOS 2.0 or later.

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CIRCLE 680 ON READER SERVICE CARD

script you cannot. Rather, you must place a graphic in one column and just the right amount of text in another.

**GRAPHICS** If you need to include graphics with your text, *Manuscript* can accommodate you by importing graphics di-



After using *Manuscript's* editor to zip through the structuring of a document, a slow but gorgeous preview formatter lets you view the document, including title page, table of contents, body, and index, in true 100 percent WYSIWYG fashion. The window in the upper-right-hand corner magnifies the portion of the document fenced in the left-hand panel.

rectly from 1-2-3, .PIC files, and *Symphony*, as well as metafiles from *Freelance Plus* and other packages; and PostScript format files.

**PRINT PREVIEW** *Manuscript* is not a WYSIWYG editor. Instead, you must use the package's print preview function to view page formatting and to see what your equations and tables will actually look like. The page preview capabilities show you a miniature picture of your page. Although it is impossible for you to read the text in the print preview mode, you can easily enlarge a portion of the preview page. Magnification allows you to inspect a portion of the page, equations for example, right down to the pixel. The designers took this course because of the huge documents that *Manuscript* is designed to handle. At that length, the amount of time it takes to build the bit-mapped displays on the graphics monitor could be quite substantial. For fast previews, you'll need a fast AT with a fast hard disk; only the Core disk benchmark tests rattle the hard disk more excitedly.

**OTHER FEATURES** Other impressive features include a Compare feature that highlights the differences between two document files, allowing you to keep an audit trail of document revisions. It also offers versatile footnotes and end notes and automatic indexing; you simply mark the words in your text and fill out the global-index page-format screen. In addition, the word processor includes the ability to print merge, as well as produce style-sheet-like templates of format settings and link them to text. The package offers 25 backslash sequences, which are imbedded formatting commands similar to *WordStar's* dot commands. For instance, typing \section\ into the document will produce an entire section title in the printed document; \line\ lets you draw a horizontal line.

**USING MANUSCRIPT** All of these features add up to one big program. Delivered on eight disks, *Manuscript* gulps down 1,921K bytes (nearly 2 megabytes) of disk space. While the package operates acceptably on an XT, the faster disk and higher processing power of an AT is very useful

## ■ THE SCIENTIFIC PC

for the package's print preview function, especially if your pages contain graphics or equations. Even on a fast AT, you'll have to wait about 1 minute to display a page containing several graphics. And if you edit large documents, you should consider getting expanded memory.

In order to use the package's print pre-

### ■ *Manuscript's* sparse edit screen allows maximum writing space.

view facility, you'll need a CGA, EGA, or Hercules Plus card with a suitable monitor. During text editing, the display is operated in text mode. Character attributes such as italics are displayed in color on an EGA or CGA, as highlights on an MDA (monochrome display adapter) or Hercules, and as true italics on a Hercules Plus.

Strangely enough, though you'll probably use an EGA or multisync monitor with the package, *Manuscript's* display includes no bizarre color palette but rather a black-and-white screen display. You can change the colors on your screen, however, if you like.

*Manuscript's* sparse edit screen allows maximum writing space. A double status line displays filename, text attribute and cursor and section position, and ruler line. An expanded status line that shows justification, indentation, and font selections is also available.

You enter the package through a main menu, referred to as the Document Manager, that offers ten command selections. In addition to the routine functions, the Manager includes the Compare feature, an import facility for ASCII, J-2-3, and *Symphony* files, and a generous file-conversion facility that accommodates DCA and *ThinkTank*.

Once you're past the main menu, the program uses a variety of commands and pop-up menu panels to accomplish its many functions. Because of the size of the package, however, the commands are inconsistent and confusing.

For instance, the package uses function



**Figure 1:** *Manuscript* is not a WYSIWYG word processor. Instead, you must use the package's print preview function to view page formatting and to see what your equations and tables will actually look like. The page preview capabilities show you a miniature picture of your page. At left you can see what such a miniature looks like when it is displayed on-screen; below is the corresponding page printed on an Apple LaserWriter.

Christian/Raskin

### EQUATIONS

*Manuscript's* equation typesetting is one of its most impressive, and one of its most surprising features. The surprise -- *Manuscript* equations are specified using a layout language, rather than by laboriously placing mathematical symbols on screen. The layout language lets *Manuscript* do the tedious work, all you need to do is use words to describe what the equation should look like. Some users will like this approach, others might prefer to move symbols on the screen to layout equations.

The following shows a few sample equation specifications on the left with the resultant output on the right.

\eqn "x = [ beta +root { beta  
super 2 - 4 alpha gamma } ]  
over { 2 alpha }\"

$$x = \frac{\beta \pm \sqrt{\beta^2 - 4\alpha\gamma}}{2\alpha}$$

\eqn "f #. # [ [ i dx over ds ]  
+ j dy over ds ] #\"

$$f \cdot \left[ i \frac{dx}{ds} + j \frac{dy}{ds} \right]$$

\eqn "ini sub C ( f #. i hat )  
ds\"

$$\int_C f \cdot \hat{i} ds$$

The biggest weakness of *Manuscript's* equation formatting is that in-line equations are limited to the height of a normal line. A better approach would be to leave extra space above and below the line so that in-line equations could be printed at their optimal size. However the formatting of the stand-alone equations is truly impressive.

### 2.TABLES

*Manuscript* gives columns all the rights and responsibilities of citizenship. Columns can be moved, joined, deleted, boxed, set in a given typeface, centered, left flush or right flush, etc. *Manuscript's* impressive column features make it easy to format complex tables. This powerful feature will be useful in many types of documents, not just in technical documents.

Columns can be used to create ordinary tables, such as the pair of columns showing equation features, or the following table of Auto Sales Data.<sup>1</sup>

AUTO SALES DATA			
	Dec 20-31 1986	Dec 20-31 1985	% Change
CHRYSLER CORP.			
Chry-Plym Div.	19,453	14,892	30.6
Dodge Div	11,695	9,638	21.3
Total Cars	31,148	24,530	27.0

<sup>1</sup> Source: Wall Street Journal, Jan 18, 1986.

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## A RECIPE FOR KING-SIZE DOCUMENT CREATION

Take the latest PC-in-the-know quiz.

**M***anuscript* is:

- a. The final draft of the Lotus story.
- b. A word processor.
- c. An outline processor.
- d. A chart and table maker.
- e. An equation generator.
- f. A page-makeup program.
- g. A document-revision aid.

If you answered a little bit of all of the above, you are on the right track.

Originally, *Manuscript* was the personal tool of 1-2-3 coarchitect Jonathan Sachs, born to aid him in churning out documentation. With a pinch of this, a dash of that, and the research efforts of Lotus's Development Corp. Engineering and Scientific Products Division (ESPD), *Manuscript* today is a powerful integrated tool combining the best (occasionally questionable) from a smattering of established applications genres. All in all, *Manuscript* is a hybrid product... tweaked and tuned to meet demands of killer-sized documents.

The designers of *Manuscript* kept its ultimate purpose in mind, and ultimately content determined its features list. A whirlwind tour of the building blocks offers insight into ESPD's priorities.

**It's a word processor.** As a stand-alone word processor, born of a different manufacturer, *Manuscript* would be in trouble (see review). However, given the breadth of its document-preparation capabilities and the sheer size of the program, certain omissions and idiosyncrasies may be forgivable.

**It's an outline processor.** The organization of ideas is vital in the technical document and a top-notch outline processor has become the first pit stop for many authors. *Manuscript* is not the first to incorporate outlining capabilities into its

document creation, but it is one of the most powerful. Not only can it collapse and expand sections and automatically handle section numbering and table of contents, but the global format of the document can be assigned as well.

**It's a chart maker and does equations, too.** *Manuscript*'s intended users do not live by text alone. They tend to rely on a mixed bag of spreadsheets, graphics, charts and tables, and equations to convey their message. *Manuscript* is dedicated to swift integration of these elements.

The table and chart features of the program bear a distinct resemblance to UN-IX's Nroff, Troff, Eqn and Tbl—the most powerful utilities available for chart and equation typesetting. The macrolike keyword commands eliminate the tedium of creating piecemeal equations from graphic symbols as other word processors such as *WordMarc* and *Volkswriter Scientific* do. Some will prefer editing the equation described in English-like text, and others would rather monkey around with a screenful of intricately placed graphics symbols.

**It's a page-makeup program.** *Manuscript*'s page-preview facility gives PC users the essential WYSIWYG capabilities, but *Manuscript* takes a different tack from the desktop publishing crowd. "Page makeup and desktop publishing programs," says Lotus spokesperson Tom Smallbone, "belong in the hands of graphic artists. *Manuscript* is a writer's tool." While *Manuscript* allows a WYSIWYG page preview, different font and point size, and on-screen columns, the tools of the desktop publishing software have a decidedly more design-oriented emphasis.

Desktop publishing programs are considerably more interactive, and the text is

more often than not supplied externally from a word-processed document. With desktop publishers you point to and move the elements of a page until you are satisfied with the page layout. Unlike these page-oriented programs, *Manuscript* is document oriented. Its page-preview facility lets you peek at the page prior to printing to spot problems, but it does not allow you to manipulate the elements. Like desktop publishers, *Manuscript* can incorporate text and graphics, but the standards are very different. If it's kerning, leading, and text wrapping you need, then *Manuscript* is not for you.

**It's a document-revision aid.** The latest user wish list includes a Compare feature that somehow lets you track the revisions made to a document over the course of its lifetime. Programs such as Broderbund's *ForComment* and Jurisoft's *CompareWrite* have made document audit and comparison their primary raison d'être. *ForComment* expands on the theme by allowing interactive comment and edits. *CompareWrite* flags discrepancies on-screen or to a printer, with a variety of display and print options. Although not as full-bodied as the standalones, *Manuscript*'s Compare feature still does the trick, making the program a candidate for legal and publishing professions.

**It's manuscript.** The final tally? *Manuscript* is a new offshoot in software genealogy and packs the clout of many of its standalone counterparts. True to its mission, *Manuscript* offers a unique path to the creation of the compound and complex document. Just who's ready to toss in the old word processor/outline/chart maker/equation writer/and so forth software and jump on the *Manuscript* bandwagon remains to be seen.

—Robin Raskin

Equations don't look like much in the page preview mode unless you scale them to full-screen size. The attractive graphics preview facility lets you check a graphic or equation without destroying your eyes.

keys and Alt-function-key combinations for most basic word processing functions. But some of the function keys also access supplemental pop-up menu panels. (While the commands on each panel are crystal clear, it is often difficult to find the correct panel.) And other function keys, such as those that control the Search and Format capabilities, prompt you with a combination of fill-in-the-blank response and yes/no toggles. Then there's the F10 key, which unlike the other function keys, uses a 1-2-3-like menu that uses a command bar and submenus to handle the on-screen window, file storage, and the all-important global document formats.

Another confusing bugaboo is the inclusion of both Cut (F4) and Delete (Alt-F4). You use Cut if you're not sure you want to delete something; the Cut material is placed in a clipboard, which saves the data and from which you can Paste it somewhere else. Delete is forever. Unfortunately, because the commands are so similar, it's easy to get confused and destroy your data.

The single most bizarre feature in the

user interface is the use of the Ins key, rather than Enter, to execute a command. Worse still, the program uses the Return key to display help screens. To further complicate matters, typing the first letter of a command works on certain menus but not on others. We never adjusted to the inconsistencies of the user interface and still have an aversion to the Ins key.

The package also falls short when it comes to providing capabilities for word processing. Unfortunately, you can't drop to DOS without quitting the program, and *Manuscript* does not make provisions for handling frequently used DOS functions such as RENAME or COPY from within the program. *Manuscript* also lacks commands that would let you delete the word to the right or left of the cursor, delete sentences, or delete lines, and so your ability to edit documents quickly is hampered. Nor does *Manuscript* include an Undo command. The complexity of this package and of structuring a document and making corrections would make such a command a real timesaver.

While sibling 1-2-3 took off because of

its programmability, *Manuscript* contains no macro facility. Although it includes a few shortcuts for some menu operations, you can't change the key assignments or program shortcuts for the menu operations you use most.

#### ROBUSTNESS AND TUTORIALS

*Manuscript* is robust, providing all the necessary error messages, prompts, and warnings. But while on-screen help is excellent in certain areas, it falls short when the going gets tough. For example, if you go to the help screen for assistance with some of the structured editing commands, the help screen will tell you that these commands exist but not what they mean or how to use them.

The documentation is substantial. The manual also includes a tutorial on structured and unstructured editing. However, we found that the tutorial was a low-level, step-by-step guide that left us wondering about the concepts of *Manuscript*. With use, several guiding principles became clear, but they never emerged from the tutorial or the reference manual.

*Manuscript* supports about 34 printers. Supported lasers are all models of the HP Laserjet and the Apple LaserWriter. In addition, *Manuscript* supports most Epson, IBM, Citizen, Okidata, and Toshiba printers. Still, *Manuscript*'s list of supported printers isn't nearly as long as some of the more-established programs.

#### CONCLUSIONS

*Manuscript* is destined to rule the tables and equations roost. Its handling of large documents is impressive, and its facilities for structured documents are powerful but rigid. However, we'd approach *Manuscript* with caution. We consider ourselves quick learners when it comes to the building blocks of word processing programs, but unless tables, equations, 1-2-3 import, or managing huge documents were an absolute requirement, we'd be reluctant to adopt *Manuscript* as our word processor of choice. *Manuscript* has several unique, outstanding strengths, but it also has some weaknesses that would handicap an ordinary program from an ordinary vendor. ☐

Robin Raskin and Kaare Christian are frequent contributors to PC Magazine.



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# THE SCIENTIFIC PC SOFTWARE



## FOR PROBLEM SOLVING

**I**t is a rare scientist indeed who doesn't use computers in his or her work. Until recently, however, most scientists have either had to write their own programs for their PCs in general-purpose programming languages such as APL, BASIC, FORTRAN, or Pascal, or adapt general-purpose software to their own specialized applications.

Although writing your own program gives you a great deal of flexibility, anyone who has spent weeks writing and debugging large programs in these languages knows that this flexibility comes at a price. Scientists also commonly use one of the many spreadsheet programs, such as 1-2-3 or *Framework*, to examine, graph, and manipulate data. These packages are ideal for

*Until recently scientists were left to their own devices when it came to PC software. But now a growing number of packages are becoming available for them. The seven reviewed here help scientists crunch numbers and study mathematical models.*

simple tasks, but writing even moderately complex analysis programs (using macros) is extremely cumbersome and time-consuming.

But a growing number of packages are becoming available that are targeted specifically at the scientific user. At their best, they combine the most useful features of the first two choices plus a good deal more.

The products in this article were selected for review because they all allow scientists to solve mathematical problems or analyze data. Some of these programs allow you to examine mathematical relations or models too complex for pencil and paper; others are more suitable for number crunching. However, you'll find a great deal of overlap, since the number-crunching programs can also help you examine models and relationships.

Macmillan Software's *Asyst*, Mathworks' *Matlab*, and Aptech Systems' *Gauss* are all geared toward the mathematically oriented scientist interested in numerical analysis applications. All provide sophisticated analytical tools—such as predefined mathematical functions and graphics capabilities for graphing those functions—as simple commands, making "programming" unnecessary for many jobs.

But while these predefined tools are powerful, all three packages also allow you to write programs for almost any calculation. The languages they include give you a new and powerful alternative to relatively cumbersome conventional computer languages such as FORTRAN, Pascal, and even APL. Programs are shorter and easier to write (although the complicated syntax of *Asyst*'s reverse Polish notation is cumbersome at first), but there is no sacrifice in speed or flexibility. These programs aren't for everybody: if your calculations aren't very large or complex, use a spreadsheet; or, if you need to perform huge numbers of calculations, use a supercomputer. But for most scientific applications, these languages can't be recommended too highly.

While all of these packages offer many sophisticated features, *Asyst* is the richest and most feature-filled. If you require large-scale mathematical applications, are able and willing to spend the time learning the rich capabilities of the program, and

## GLOSSARY OF EQUATION PROCESSING TERMS

**Algorithm** A step-by-step procedure for solving a problem.

**Array** A collection of elements organized in tabular form in which you use indexes to access each element. A single-dimensional array has a single row of elements and is indexed using a single integer. A two-dimensional array can be viewed as a rectangular table, while a three-dimensional array can be thought of as a cube. An array can have any number of dimensions.

**Complex number** A number that is the sum of a real number and an imaginary number. It is often written as  $1 + 2i$  where 1 is the real number and 2i is the imaginary number. See Imaginary number for more details.

**Curve fitting** The process of computing an equation and graphing it so that the graph passes through a given set of points.

**Derivative** The converse of integration. You compute the derivative of an equation based upon some variable within the equation. The derivative is the change of the function with respect to a change in the variable. For instance, the derivative of distance with respect to time is velocity. The derivative of velocity with respect to time is acceleration.

**Differential equations** Equations that include derivatives.

**Expression** An equation.

**Fast Fourier Transform (FFT)** A fast numerical method of transforming numerical signal data into data that is easier to manipulate when performing signal processing algorithms.

**Functions** Procedures used to find a result. Some examples of trigonometric functions are sine  $x$  and cosine  $x$ , where  $x$  is the parameter.

**Global variables** Variables that are accessible from within any function or the main part of a program.

**Imaginary number** A number that is implicitly multiplied by the square root of -1, also written as  $i$ . Multiplication of two imaginary numbers results in a real number times -1. Multiplication of a real and an imaginary number gives you an imaginary number. Addition of a real and imaginary number results in a complex number. Examples:

$4i + 2i = -8$  (real number)  
 $4 + 2i = 8i$  (imaginary number)  
 $4 + 2i = 4 + 2i$  (complex number)

**Indexes** Integer references to elements

can fit it into your budget, *Asyst* will not disappoint you. (A less expensive, menu-driven but more limited version, *Asystant*, is available for those who don't need the full power of *Asyst*.) Of all the packages, it is the most flexible and has the most features, and the graphics are nothing short of superb. In addition, it includes an optional package that allows *Asyst* to interface with laboratory equipment, giving you a unified, powerful data collection and analysis system.

Although there are significant differ-

ences between them, *Asyst*, *Matlab*, and *Gauss* are powerful tools and, as such, can't be used casually. They are designed primarily for those who are already reasonably comfortable with mathematics and computers. Those with fewer computational needs who don't want to spend weeks learning a new language can use *Point Five* for number crunching. Although *Point Five* has fewer features and no language of its own, it is easier to start using immediately.

The other class of products reviewed



within an array. Access to a specific element in an array requires one index value per array dimension.

**Infix notation** Conventional notation for writing equations in which binary operators have their operands on either side. See Notation for examples.

**Integer** A positive or negative whole number. The range of integers on a particular computer is normally limited to some fixed size, such as 16 bits.

**Integrals** The function of applying the integration process to an equation.

**Integration** The process of finding the area under a curve. This can be done using numerical or symbolic methods. The latter results in a new equation that computes the area. Integration of a curve is with respect to one of the variables describing the curve. For example: the integration of velocity with respect to time is distance. See also Derivatives.

**Local variables** Variables that are accessible from within a particular function definition but not from other functions or the main part of a program.

**Loop** A programming procedure that repeatedly executes a portion of a program until some termination condition is met. The part of the program following the loop section is then executed.

**Multidimensional array** An array using more than one dimension (see Arrays). A single-dimensional array is often called a vector. A two-dimensional array is often called a matrix.

**Notation** The following examples show the various notations for presenting equations.

Simple Example:

Notation	Equation
Infix	$A + 2$
Polish	$+ A 2$
Reverse Polish	$A 2 +$

Complex Example:

Notation	Equation
Infix	$(A * \text{SQR}(X)) + (B * X) + C$
Polish	$+ + * A \text{SQR } X * B * X C$
Reverse Polish	$C X B * X \text{SQR } A * + +$

**Polish notation** A method of writing an equation as a string of elements with the operation listed first followed by the variables on which it is to be performed. See Notation for examples.

**Precision** A method of describing the accuracy of a number. It is normally given in terms of digits or bits. Single precision and double precision describe the way a particular application stores data. Double-precision numbers normally occupy twice the amount of space as single-precision numbers; they do not necessarily

have twice the range and accuracy of a single-precision number, but rather a greater range and/or accuracy.

**Reverse Polish notation** Polish notation in which the parse string is reversed. See Notation for examples.

**Scalar** A single element. The element is normally a number when used in the context of numerical calculations.

**Simultaneous equations** A set of equations that use the same set of variables. A solution for the equations can be found—if it exists—if the number of variables matches the number of unique equations. An example of a set of simultaneous linear equations is

$$\begin{aligned} 2X + (5 * Y) + (2 * Z) &= 12 \\ (3 * X) + (7 * Y) + Z &= 12 \\ (5 * X) + Y + (3 * Z) &= 12 \end{aligned}$$

**Systems** See Systems of equations.

**Systems of equations** A set of simultaneous equations.

**Vector** A single-dimensional array of elements.

**Word** A unit that describes the width of the primary data item within a computer. A word is normally defined in bits. An 8-bit computer has an 8-bit word length, while a 16-bit computer has a 16-bit word length.—William G. Wong

here helps you solve problems and build models (rather than efficiently solving already well-defined problems). For instance, *TK! Solver* allows you to solve models directly, without having to write programs to create problem-solving algorithms. Instead, *TK! Solver* lets you concentrate not on programming but on the problem at hand.

Unfortunately, *TK! Solver* is difficult to use. *Eureka*, a new program from Borland International that was still in beta testing at the time we assembled these reviews,

promises to perform all the functions of *TK! Solver*. Our preliminary tests of the product revealed it to be much easier to handle, with pull-down menus that let you use the program without even reading the manual. It also supports EGA graphics.

*MathCAD* and *muMATH Program* fit into yet another slightly different category of product. They are best suited to be mathematical tools. For quickly examining mathematical relationships much as you would at a blackboard (which the program was designed to resemble), *Math-*

*CAD* is unexcelled. Using *MathCAD* is, as its advertisements proclaim, more like using a blackboard than like using a computer language. It lets you write out equations, including mathematical symbols such as integral signs and fractions, performs calculations with those equations, and lets you graph your results.

*muMATH Program* is at the opposite extreme of mathematical programs. Its front end looks exactly like a computer language, it is quite sparse and unforgiving, and rather than being a fancy calcula-

## ■ THE SCIENTIFIC PC

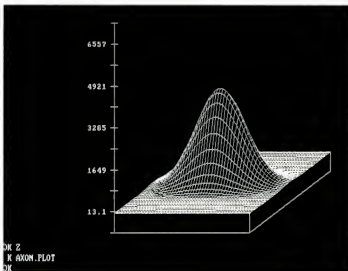
tor, it doesn't even do floating-point arithmetic. (The only numbers it deals with are integers and fractions of integers, so if you want to know the square root of 2, forget it.) Instead, *muMATH* is a symbolic manipulator, using artificial intelligence techniques to solve problems in algebra, calculus, and even differential equations. It is an impressive program and should be judged on its own merits. Nevertheless, since most problems cannot be solved analytically (and even if they can, *muMATH* cannot always solve them), it is not useful for most scientific applications.

In the reviews and features table that follow, we examine these seven packages in much greater detail. For anyone interested in scientific or mathematical programming on the PC, they definitely merit a closer look.—Clay Reid

### Asyst

*Asyst*, from Macmillan Software Co., is at the top of the heap when it comes to PC software for scientific data collection and analysis. A programming language that is a dialect of FORTH, it provides a great deal of power and flexibility.

*Asyst* comes in four modules that can be purchased separately. The base system provides graphics capabilities, statistics, and a system for programming. The analy-



*Asyst's graphics are very flexible. For instance, the program lets you plot any function it understands, even those you have defined yourself, as well as three-dimensional plots.*

sis module includes regression, curve-fitting, Fast Fourier Transforms, and much more. The data acquisition module has facilities for analog-to-digital sampling, digital-to-analog output, digital I/O, and simple timing of external events. And an IEEE 488 interface module allows you to interface instruments that use this particular protocol. For the sake of comparison with the other packages reviewed, *PC Magazine* looked only at the analytical modules of the package.

You can either use the analytical modules as a powerful, programmable calculator (that uses reverse Polish notation, or RPN), or use the high-level language for programming and analysis. You use *Asyst's* programming language to strip together predefined "words," which are functions, or procedures, that range from primitive mathematical operations such as addition to complex operations on arrays such as smoothing or plotting. Using these "words" saves you an enormous amount of programming time.

*Asyst* also provides a simple text editor that lets you create and edit your own short word definitions. One advantage of using *Asyst's* editor for this purpose is that once

you compile a program written with the editor, the program will bring you back to the position where an error occurred. The disadvantage is that you have to learn a new text editor. I would rather import my programs into my favorite word processor for editing.

*Asyst's* language is good for mathematical operations because you can specify an equation in an algebraic format, which makes it clear and easy to use. But for other programming commands, *Asyst* has some of the deficiencies of FORTH. It uses the RPN syntax, which is more difficult to read than conventional infix notation. For instance, in a language like Pascal, you would write the following:

```
IF A > B THEN Print "A > B"
```

In *Asyst's* RPN you would write:

```
A B = IF "A > B" Print THEN
```

In addition, the language uses only global variables that affect the entire program; it has no local variables that affect only a small portion of a program. While the lack of local variables would be more of a problem in less compact languages than FORTH, if more than one person works on



### FACT FILE



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N.Y.)  
(212) 702-3241

**List Prices:** With modules 1 and 2, \$1,695. With modules 1, 2, and 3, \$1,995. With modules 1, 2, 3, and 4, \$2,195. **Requires:** 512K RAM, two disk drives or hard disk, DOS 2.0 or later.

**Supports:** IBM CGA or EGA; or Hercules monochrome/graphics card or color/graphics card, 8087 or 80287 math coprocessor.

**In Short:** *Asyst* is powerful and flexible. Its programming language is a dialect of FORTH. Copy protected.

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the same program, each will have to take care to clearly document the variables used.

**GRAPHICS** *Asyst's* graphics capabilities are so good that I would recommend the package on their merits alone. Mathematicians and scientists constantly use charts to test their theories. They normally collect data and plot it, then compare the actual data to plots of a mathematical model. The goal is to find the formula whose plot most closely matches the plot of the actual data. *Asyst* is a wonderful tool for this type of analysis because it lets you plot any function that the program can understand, even functions that you define yourself (including three-dimensional plots), all by typing **Y AUTO PLOT** or **AXON .PLOT**.

In addition, the package allows you to place graphs of any size anywhere you like on the screen, in any colors. You can add grids, tick marks, and more. Not only that, but *Asyst* distinguishes the hidden lines in three-dimensional plots by showing them in a different color.

*Asyst* supports the IBM Enhanced Graphics Adapter as well as Epson printers and HP plotters. However, it would be nice if the package supported more output devices.

*Asyst* can exchange data with other programs such as *1-2-3*, by using ASCII files. (DIF and *Lotus* file importing capabilities are planned for the future.) To do so you use the package's file system. A file for import or export can contain anything from integers to strings to floating-point arrays.

The package does have a number of annoying limitations. Arrays are limited to slightly less than 65,000 elements, and, because the package generates scratch variables, if you try to compute the FFT of a large array, for instance, you'll soon run out of memory. In addition, while the program emulates some DOS commands, the emulation is not exact. For example, in DOS you would type **COPY A:\*.\* B:** while in *ASYST* you must say **copy A:.\*.\* to B:.\*.\***. In addition, support for extended memory would be most desirable.

The technical support from the company is very good and friendly. Each module is accompanied by a large manual, which consists of a tutorial and a reference

("glossary"). The manuals are clearly written, although some of their examples do not work exactly as the manual claims they should. The package includes an extensive help facility that recapitulates the contents of the reference portions of the manuals. Unfortunately, invoking the help facility destroys the data on your screen.

For those who are not programmers, Macmillan Software also offers a menu-driven package called *Asystant*, which includes many of the functions of *Asyst* but does not have a programming language.

Although *Asyst* is not yet a perfect system, its flexible graphics and programming language make it a tremendously useful tool for the scientist and engineer.

—Ehud Kaplan


## Gauss


Aptech Systems' *Gauss* is an array-based analysis package. It comes in 11 modules that allow you to perform statistical analyses such as nonparametric statistics and nonlinear estimation, as well as generate pseudorandom numbers, solve systems of nonlinear equations, and compute Fast Fourier Transforms.

*Gauss* provides an interactive mode with resident commands, functions, and operators that allow you to carry out fairly extensive computations with relatively few keystrokes. Plus, it uses algebraic notation.

Although you can do quite a lot of computing in *Gauss* without writing a single program, the package also provides an easy-to-use full-screen editor for writing programs.

*Gauss* will be most useful to those who are comfortable with the C programming language. In fact, one might describe *Gauss* as an efficient C compiler and programming environment with powerful array operators. *Gauss's* interactive mode and extensive array operations are also reminiscent of APL, so APL fanciers who want a break from reading and remembering that language's hieroglyphic-like symbols may also find satisfaction with *Gauss*. You can compile the completed programs relatively quickly (as compared to compiling words in *Asyst*) and run them from the editor with a single keystroke. An error-checking system brings you back to any

**FACT FILE**

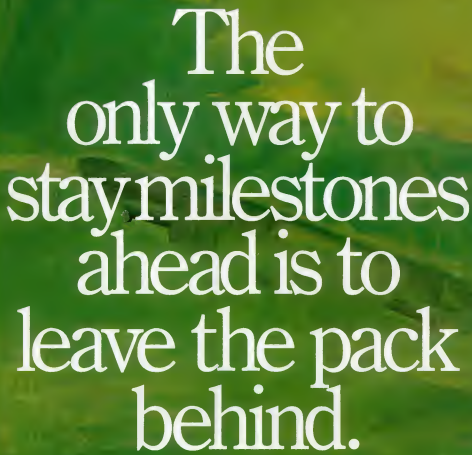
  
Aptech Systems Inc.  
P.O. Box 6487  
Kent, WA 98064  
(206) 631-6679  
List Price: Language only, \$200; language with mathematics and statistical systems, \$300.  
Requires: 320K RAM, two disk drives or hard disk, DOS 2.1 or later.  
Supports: IBM CGA or compatible. (Next update will work with IBM CGA, EGA, or compatible and Hercules monochrome/graphics card or compatible.)  
In Short: *Gauss* is an array-based analysis package. The program includes an interactive mode for performing computations as well as a programming environment, but needs work on its user interface. Not copy protected.  
CIRCLE 684 ON READER SERVICE CARD

lines in the editor that generate errors.

Another nice feature is the program's foreign-language interface for systems using DOS 2.1 or later. This interface allows compiled FORTRAN, assembly language, and compiled C programs to be called as functions by programs written in the *Gauss* language.

Although *Gauss* is comprehensive, it is difficult to use, requiring you to learn and remember many command names and rules. While the documentation is generally well organized, well written, and useful, its lack of a context-sensitive help facility makes the program all the more difficult to use.

A good example of this is the package's graphics capability, which is designed to allow you to plot most of the package's functions. In order to produce the EGA high-resolution graphics in either two or three dimensions, you must call one of two procedures from disk. Both of these procedures require you to specify 28 arguments. For example, you must specify the position of the axis, the length of tick marks, where they are placed, where you want the labels to go, etc. While it is possible to write and run a command file to specify the arguments, you certainly cannot look quickly at some data or graph the results of a calculation.



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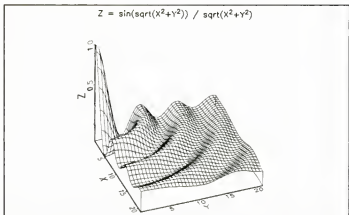
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Milestones Ahead.

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Gauss lets you plot most of the package's functions. But doing so is no simple task, requiring you to call a special procedure from disk and specify 28 separate procedures.

Gauss's speed in performing calculations is roughly equivalent to the other products tested. On an 8-MHz AT with a 6-MHz 80287 math coprocessor, the package calculated a 2,048-point FFT in roughly 5 seconds.

Ultimately, speed is not as important a consideration as are some of the limitations that Gauss imposes on matrix operations and on the use of its modules. For instance, Gauss limits matrices to two dimensions, with a maximum of only 8,192 elements. In addition, using the modules—which contain most of the sophisticated statistical analysis, equation-solving, and time series analysis algorithms—requires a good deal of effort. For instance, you cannot just type "FFT" in the interactive mode and expect to get an answer. Instead, you must first load a machine language routine to locate and call up the function from memory, or write a batch file to automatically load the routine.

Gauss combines the features of a high-level compiled language like C with the interactive mode and the versatile matrix operations of a language like APL. Those who like working with C or APL will like working with the Gauss language. As a software package, Gauss could use work on its user interface and graphics output. Gauss also seems not to take full advantage of its computational efficiency by im-

iting its matrix operations and the implementation of its application modules.

—Keith Purpura

## MathCAD

MathSoft's MathCAD is like a cross between computer software and a math teacher's chalkboard. You can use MathCAD's screen like a chalkboard on which to write equations, just as you would scratch them on paper—complete with Greek symbols, superscripts, subscripts and fractions. You can scribble notes or plot graphs as you see fit. But because it is software, this chalkboard also understands the mathematics written on it and calculates values for the mathematical expressions you write.

The software also includes some basic word processing functions, such as the ability to move equations in a snap; and it adds the characteristics of a programming language, since it can set up and perform iterative calculations. And to top it all off, it gives you the freedom to place your equations wherever you want on the screen.

MathCAD's user interface is one of its more impressive features. You can enter commands via command line or pull-down menus. While the pull-down menus will appeal to newcomers, MathCAD's intu-

itive use of function keys and English-like commands will attract experienced users more interested in speed than ease of use.

Like word processors, MathCAD lets you create, edit, and print documents. Within each document, MathCAD stores each equation, section of text, or plot in a "region," which is simply a subdivision of the document. MathCAD commands make it easy to edit, move, and delete any region.

MathCAD's display is WYSIWYG and has text-handling features such as automatic word-wrap, adjustable margins, and form feeds that you can use to ensure that regions won't straddle a page break.

To begin calculations, you assign a value, range of values, or expression to each variable. Then you type in the equation and MathCAD computes the results. When you assign a range of values to a variable, MathCAD computes a result for each value within the range. You may then carry out further calculations with additional equations using the same and any additional variables.

When you change a variable's value, MathCAD automatically recalculates any equations that lie below the change in the document and are affected by that variable. You can also specify a variable to be global, causing MathCAD to recalculate

	<h3>FACT FILE</h3>
	<p><b>MathCAD, Version 1.1</b> MathSoft Inc. One Kendall Sq. Cambridge, MA 02139 (800) MathCAD (outside Mass.) (617) 577-1017 List Price: \$249</p>
<p><b>Requires:</b> 512K RAM, one disk drive, DOS 2.0 or later.</p>	<p><b>Supports:</b> IBM CGA, EGA, or compatible; Hercules monochrome/graphics or color/graphics card or compatible.</p>
<p><b>In Short:</b> MathCAD allows you to write equations on your screen just as on a chalkboard, calculate them, and graph them with ease. Since the program constantly calculates and recalculates equations, it can be slow, so the use of a math coprocessor is recommended. Not copy protected.</p>	<p><b>Circle 666 on Reader Service Card</b></p>

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MONTREAL Mar. 24, May 12; NEW ORLEANS Mar. 27, Apr. 27, May 18; NEW YORK Mar. 25, Apr. 7, Apr. 24, May 14; ORLANDO Mar. 20;  
OTTAWA Mar. 23, May 11; PHILADELPHIA Mar. 27, Apr. 27, May 25; PHOENIX Mar. 23, Apr. 20; PITTSBURGH Apr. 6, May 11; PORTLAND Mar. 31, May 4;  
PROVIDENCE Apr. 9; SACRAMENTO Apr. 24; SALT LAKE CITY Mar. 23, Apr. 27, May 22; SAN ANTONIO Apr. 1, May 13; SAN DIEGO Apr. 10, May 13;  
SAN FRANCISCO Apr. 6, Apr. 30, May 11, May 29; SAN JOSE May 26; SEATTLE Apr. 1, May 5; ST. LOUIS Mar. 27, May 1; TAMPA Mar. 25, Apr. 29;  
TORONTO Mar. 26, Apr. 16, May 7, May 21; VANCOUVER Apr. 2, May 7; WASHINGTON Mar. 30, Apr. 28, May 26.



## ■ THE SCIENTIFIC PC

all equations that contain the variable, regardless of where the equations are located.

Inserting traditional mathematical operators, such as square root and summation symbols, into the display is easy with *MathCAD*'s quick reference card. For example, " $\sqrt{x}$ " will be displayed as the square root of  $x$  and " $\sum y$ " as the summation of  $y$  over values of  $x$ .

*MathCAD* allows you to append one document to another, and READ and WRITE statements that you include in the body of your document let you read data from, or write data to, external files.

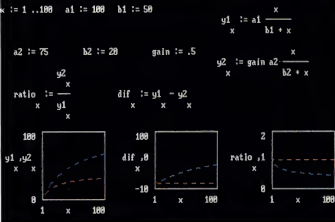
**POWER FEATURES** Were it not for a small handful of limitations—such as the lack of built-in conditional branching capability and the ability to handle only one-dimensional arrays—*MathCAD* would be an excellent alternative to programming languages for those whose needs are primarily mathematical. As it stands, the program will make you wonder what you ever saw in your pocket calculator.

Like programming languages, *MathCAD* cannot solve an equation for you: it simply calculates the result once you have solved the equation for one variable. And *MathCAD* boasts a nice assortment of built-in functions—including Bessel, Fourier Transform, statistical, and trigonometric functions—and also allows user-defined functions.

But *MathCAD* tops most languages by going one step further. For calculus fans, Version 1.1 includes integral and derivative calculation, as well as a function that uses an iterative technique to find the roots of simple polynomial expressions (values of the variable that force the polynomial to a value of zero). You must supply an initial guess, however, and the quality of the solution depends on the quality of your guess.

*MathCAD* can also easily generate plots that would keep a FORTRAN programmer busy for weeks. To generate a plot you type the @ symbol. A blank plot appears on the screen, and you enter the equations you wish to graph and the endpoints of the scale. *MathCAD* allows you the freedom to select plot size, grid spacing, plot symbols, and logarithmic or linear scaling. Although you can plot multiple expressions

TRANSMISSION FROM RETINA TO LGN vs CONTRAST, ASSUMING A MICHAELIS-MENTEN RELATIONSHIP FOR THE CONTRAST-RESPONSE FUNCTIONS.



*MathCAD* allows you to mix text, equations, and graphics together on a single screen. When you change a variable in an equation, the graph will automatically reflect that change.

on a graph, the four available colors and six plot symbols limit the number of expressions you can distinguish.

Another special feature, which should grab the attention of those in the physical and applied sciences, is *MathCAD*'s ability to check equations for dimensional consistency. In a slightly odd but powerful scheme, the program requires you to define any units that you will be using in calculations.

You define units in terms of four basic dimensions—length, time, mass, and charge. For example, "inch=1L" designates an inch as one unit of length. Once you have defined units, you can mathematically combine them in any way to form new units (for example, "ft = 12 \* inch" defines a foot equal to 12 inches).

To keep from having to redefine units each time you work in *MathCAD*, you can save unit definitions and append them to documents when needed. You can also use the example files *MathCAD* supplies for the MKS, CGS, and U.S. customary systems of measurement.

When you use units in an equation, *MathCAD* displays the dimensions for the calculated result and flags an error if your

dimensions are not consistent (if you tried to add feet to pounds, for example).

**SPEED** Since *MathCAD* is constantly calculating and recalculating the equations in your document, the program can be slow at times, but the addition of a math coprocessor speeds response time considerably. After I added an 80287 chip, the time it took to load a sample document fell from 43 to 15 seconds.

You can also speed operation by disabling the automatic recalculation feature: you can specify that some or none of the equations in your document are to be updated when you change variable values.

*MathCAD*'s user support seems responsive, and its documentation is excellent. I was able to use the entire manual as a tutorial. The *MathCAD* disks include example documents for tasks ranging from calculating friction coefficients for braking—an example any mechanical engineer should appreciate—to computing mortgage payments. The upgrade manual for Version 1.1 is equally well written, although a combined manual would make the documentation easier to use.

Overall, *MathCAD* is an excellent

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## Equation Processors: Summary of Features

### PROGRAM FEATURES

Product/ Manufacturer	MathCAD MathSoft Inc.	TIC Solver Universal Technical Systems	Point View Pacific Crest Software	Gauss Aplech Systems Inc.	myMATH Program Microsoft Corp.	Mathlab The Mathworks Inc.	Asyst Macmillan Software Co.
Price of package tested	\$249	\$250	\$295	\$300	\$300	\$695	\$1,695
<b>NUMERIC SUPPORT</b>							
Infinity	○	○	○	○	●	●	○
Integers	●	●	●	●	●	○	●
16-bit integers	○	●	○	○	○	○	●
32-bit integers	○	●	○	○	○	○	●
Variables	○	○	○	○	●	○	○
Rational numbers	○	●	○	●	○	○	○
Complex numbers	●	●	○	●	●	●	●
Time/date	○	○	○	○	●	○	○
Ranges	●	●	○	○	○	○	●
Strings	○	○	○	○	○	●	○
Predefined constants	●	●	○	●	○	●	●
User-defined constants	●	●	○	●	○	●	●
User-definable units of measurement	●	●	○	○	○	○	○
<b>FLOATING POINT</b>							
8087/80287 support	●	●	●	●	N/A	●	●
Precision	Double	Single, double	Double	Double	N/A	Double	Single, double
Format	IEEE	IEEE	IEEE	IEEE	N/A	IEEE	IEEE
<b>STRUCTURE SUPPORT</b>							
Array dimensions	1	1	2	2	Unlim.	8,100	16
Lists	○	○	○	○	●	●	●
<b>FUNCTIONS</b>							
User-definable	●	●	●	●	●	●	●
Financial	○	○	○	○	○	○	○
Logical	●	●	●	●	●	●	●
Trigonometric	●	●	●	●	●	●	●
Arithmetic	●	●	●	●	●	●	●
Logarithmic/exponential	●	●	●	●	●	●	●
Summations	●	○	○	○	●	●	●
Integrals	●	○	●	●	○	○	●
Differentials	●	○	○	○	●	●	●
Bessel	●	○	○	○	○	●	●
DOS access	●	○	○	○	○	○	●
File access	●	●	●	●	○	○	●
<b>ARRAY FUNCTIONS</b>							
Arithmetic	●	○	●	●	●	●	●
Reduction	○	○	○	○	○	○	○
Inner product	○	●	○	●	○	○	○
Inversion	○	○	○	○	○	○	○
Expansion	○	○	○	○	○	○	○
Outer product	○	○	○	○	○	○	○
<b>COMPUTATION CONTROL</b>							
Automatic	●	○	○	○	○	○	○
Manual	○	●	○	○	○	○	○
<b>SOLVES</b>							
Equations	●	●	●	●	●	●	●
Simultaneous linear equations	○	●	○	●	○	○	○
Simultaneous nonlinear equations	○	●	○	○	○	○	○
Symbolic equations	○	○	○	○	○	○	○

●—Yes ○—No N/A—Not applicable; uses only rational arithmetic.

## USER INTERFACES

Product	MathCAD	TKI Solver	Point Five	Geoss	mcMATH Program	Matlab	Anyt
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### PROGRAM INTERFACE

Commands	●	●	○	○	●	●	●
Menus	●	●	●	○	○	○	○
Program creates batch files	○	○	○	●	○	●	○
Program creates keyboard macros	○	○	○	○	○	●	●

### ON-SCREEN DATA FORMATS

Spreadsheet	○	○	●	○	○	●	●
Tabular	○	●	●	○	○	●	○
Document (free-form)	●	○	○	●	●	●	○

## DATA INPUT/OUTPUT

Product	MathCAD	TKI Solver	Point Five	Geoss	mcMATH Program	Matlab	Anyt
---------	---------	------------	------------	-------	----------------	--------	------

### INPUT OR IMPORT EQUATIONS

Manually	●	●	○	●	●	○	●
From a text file	●	○	●	●	●	●	●
From a spreadsheet file	○	● (TKI Solver)	○	○	○	○	○

### INPUT OR IMPORT DATA

Manually	●	●	○	●	●	●	●
From a text file	●	○	●	●	●	●	●
From a spreadsheet file	● (.WKS, .WK1)	● (.DIF)	○	○	○	● (.DIF, .WK1, .WKS)	● (.DIF)
From a database file	○	○	○	○	○	○	○

### DATA OUTPUT

User-definable formatting	●	●	○	○	○	●	●
---------------------------	---	---	---	---	---	---	---

### OUTPUT DEVICES SUPPORTED

Printer	●	●	●	●	●	●	●
Text file	●	●	○	●	●	●	●
Word processor	○	○	○	○	○	● (ASCII)	○
Spreadsheet	○	● (.DIF)	○	○	○	○	○

### GRAPHIC OUTPUT

On-screen	●	●	●	●	○	●	●
Printers supported	IBM 5152 Graphics Printer, HP Laserjet, Laserjet Plus	Dot matrix	IBM 5152 Graphics Printer	None	None	Dot matrix, laser	Dot matrix, HP Laserjet
Plotters supported	None	None	None	None	None	None	HP 7470, 7440, 7475A

## ■ THE SCIENTIFIC PC

product. It is already packed with features, and the release of Version 1.1, with welcome enhancements so soon after release of the original product, would seem to indicate that it will keep getting better.

Whether you begin using it for its ability to generate quality printed documents or for its exceptional number-crunching capabilities, *MathCAD* will likely become your tool of choice for most of your mathematics needs.—Ellen Bush

## Matlab

Mathworks' *Matlab* is a high-level programming language designed especially for performing calculations on arrays. It implements a very extensive set of powerful array-handling algorithms (which come from the LINPACK and EISPACK libraries of matrix procedures) as primitives into an interpreter. In this way, *Matlab* combines the convenience of interactive use with the efficiency of highly optimized code.

*Matlab* programs tend to be short, readable, and very fast. The syntax closely resembles common algebraic notation, which means that there are no special characters to memorize (as in APL) or any reverse Polish notation (as in Ayrst). The program is fast because the code uses a concise in-line syntax for the inner loops typically found in array-handling programs that cycle through indexes of arrays. This inner looping process consumes the most time in array computations. The following is an example of the syntax:

```
X=(0:.1:.5)
```

assigns a 1-by-6-row matrix to the variable *x*, containing the elements 0, .1, .2, .3, .4, .5.

```
Y=sin(X). *cos(X)
```

works element by element, and

```
Y=Y' * Y or Y=Y * Y'
```

replaces *y* with its dyadic or scalar product of *y* with itself.

With its implicit dimensioning, *Matlab* is much easier to use than the strongly typed languages, such as Pascal or Modula, in which you have to write detailed specifications. And even though programming theorists argue that those strongly typed languages should help you trace errors better, I found that I had no undue trouble tracing errors because the programs were so short.

*Matlab* requires large contiguous blocks of memory to hold array data. However, because the language doesn't require fixed variable definitions, the program scatters the data around in memory. As a result, you stand a good chance of running out of memory in a long session or if you deal with long arrays. You'll there-

fore need to perform a "pack" procedure every now and then to compress the variables in the work space. This procedure writes all of the data to the disk and reads it back into memory. Although this is a rather primitive method of packing, it is adequate for the amount of memory that is available for data storage under DOS 3.2.

On a 640K-byte PC, about 320K bytes are available for data storage. Real-valued variables are stored in 8 bytes, and complex valued in 16. Arrays may have one or two dimensions with a maximum of 8,188 elements.

A convenient feature of the program is that you can execute DOS commands from within *Matlab*, as well as execute other programs, then jump back to *Matlab* at the point where you left off without losing any data. You can also build *Matlab* commands that execute compiled programs written in another language.

*Matlab*'s on-screen graphics are simple to use. Besides the usual *x-y* plots, *Matlab* allows you to create polar plots and perspective plots of three-dimensional surfaces (which look like a flying carpet) with the hidden lines removed.

But while these graphics are well suited to data inspection, the current version of

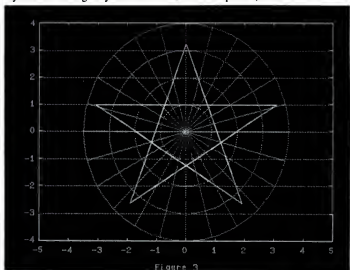


Figure 3

*Matlab*'s on-screen graphics are easy to use. Besides the usual *x-y* plots, you can plot most data stored in arrays as well as polar plots.



## FACT FILE



### Matlab, Version 2.0

Mathworks Inc.  
20 N. Main St., #250  
Sherborn, MA 01770  
(617) 653-1415

List Price: \$395 (for universities); \$695 (for commercial users).

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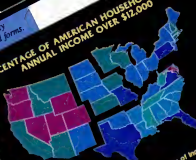
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## ■ THE SCIENTIFIC PC

the package does not support color or any output devices, which means that the only way you can get a hard copy is by doing a screen dump. (A new version that should be available by the time you read this will support color as well as a long list of plotting devices.) In the current version, the simplest way to output data is by using the diary file, which collects all text output to the screen, including all issued commands, and saves it to a file. The package also includes a special "translate" command that can convert data to and from ASCII, *Matlab* internal, FORTRAN unformatted, binary stream, or .DIF files.

*Matlab* comes with an extensive on-line help facility that even allows you to write descriptions of your own code. The documentation is well organized and includes a good tutorial. But while adequate, the manual is not complete. It should, for instance, mention the useful fact that you can't put blanks between a function name and the following parenthesis, or that complex and imaginary numbers require 16 bytes while real numbers require 8 bytes. Nor should you have to get an error message to discover that an array can only have 8,188 entries.

Several "toolboxes" of external *Matlab* commands are available as optional add-ons. I was most impressed by the "System Identification" toolbox that helps you find laws that relate experimental input to the results it produces. This toolbox is complemented by an extensive graduate-level course text, *Theory for the User*, on the same subject. The text covers the basic principles of system identification and includes many examples and problems. Course outlines and even a solution manual for the problems are available from the publisher. In addition, there is a "Control System" toolbox that provides you with special control engineering functions.

What is lacking in *Matlab* is the ability to define higher than two-dimensional arrays. It would also be nice if increments in loops could include complex numbers. But these are minor points in comparison to the strengths of the package. Even though I did not know *Matlab* two weeks ago, I would not want to miss it now in my daily work. If you run out of memory, there is a VMS version available to run on

a VAX, and it does not pay to wait for the next version of the package, given the update policy of Mathworks. The company promises a free update for any registered legal user who reports a previously unreported bug or contributes any program file of sufficiently general interest to be included in the already extensive set of utilities distributed with the program.

—Martin A. Burschka

## muMATH Program

If you want to find the standard deviation of a data sample, take the Fourier Transform of an array, or calculate the interest due on a mortgage, Microsoft Corp.'s *muMATH Program* is not for you. However, if you have a complex problem in algebra or even vector calculus that you are unwilling or unable to solve by hand, *muMATH* may be the only widely available PC program that can come to the rescue.

The reason is that other numeric processors generally use the brute force of the PC's computational capabilities to perform calculations. They also aim at finding inexact floating-point solutions to numerical problems. But *muMATH* uses artificial intelligence techniques that apply the rules of algebra and calculus to simplify equations and to solve them exactly and symbolically.


*muMATH*'s capabilities are impressive. Although the exact rational arithmetic it uses is much slower than floating-point arithmetic (finding the product of two  $44 \times 44$  matrices took *muMATH* over 5 minutes; *Asyst* handled the same problem in 12 seconds), its capacity for handling an unlimited number of significant digits is remarkable for those used to rounding off errors in computation. The best example of this is the program's ability to deal with integers of arbitrary length. By simply typing 5,000! ( $5,000 \times 4,999 \times 4,998 \dots$ ), *muMATH* correctly calculates all 16,326 digits in 7 minutes.

Less dramatic, but more useful, is *muMATH*'s ability to do nonnumeric, symbolic mathematical transformations. The program can do algebraic manipulations and solve polynomial equations up to fourth order exactly. It also offers a vast repertoire of more esoteric mathematical abilities, from the simplification of trigonometric expressions to the calculation of a Taylor series up to any order.

A sample calculation will give you a better idea of *muMATH*'s potential usefulness. Symbolic integration is one of the package's more impressive features. By entering the simple formula for an integral with respect to  $x$ — $\text{INT}(X^6 \sin X, X)$ —*muMATH* types out the following answer in 1 second:


$$720 X \sin X - 360 X^2 \cos X - 120 X^3 \sin X + 30 X^4 \cos X + 6 X^5 \sin X - X^6 \cos X + 720 \cos X.$$

While this example shows that *muMATH* can solve problems that other programs couldn't touch, it is unclear just how useful the program would be in solving real-world problems. It can simplify extremely complex equations and perform long calculations without any round-off error. But just as you don't always know beforehand whether algebraic manipulations can simplify a problem, when you use *muMATH* to perform such manipulations, you run the risk that these "simplifications" will prove to be more complicated than the original expressions. Furthermore, unless the solution to a problem has a simple, analytic form, you really might be better off using one of the other products to solve it quickly and to reasonable precision. Even if simplification is possi-



**PC**

**FACT FILE**



**muMATH Program,**  
Version 4.12  
Microsoft Corp  
16011 N.E. 36th Way  
P.O. Box 97017  
Redmond, WA 98073  
(800) 426-9400  
(206) 882-8089

List Price: \$300  
Requires: 128K RAM, one disk drive, DOS 1.1 or later.

**In Short:** Unlike the other packages reviewed here that calculate solutions to equations and find inexact floating-point solutions to numerical problems, *muMATH Program* uses artificial intelligence techniques that apply the rules of algebra and calculus to simplify equations and solve them exactly and symbolically. Not copy protected.

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CIRCLE 328 ON READER SERVICE CARD

## ■ THE SCIENTIFIC PC

```
003--z=i*sin(i*PI)*cos(i*PI+phase)
004--a=-1
005--b=-16.9
006--x=(a*i^2+b*i)/100
007--z=y+x
008--linegraph(i,x,y,z)
009--y=1000*sin(i*PI)*cos(i*PI+phase)
010--a=-1
011--b=-16.9
012--x=(a*i^2+b*i)/100
013--z=y+x
014--linegraph(i,x,y,z)
```

```
001 i=index(100)
002 phase=45.0
003 y=1000*sin(i*PI)*cos(i*PI+phase)
004 a=-1
005 b=-16.9
006 x=(a*i^2+b*i)/100
007 z=y+x
008 linegraph(i,x,y,z)
009
010
```

Mem:351/353 Insert Arrows Caps-Off Disp-ON Calc-ON Print-Off

Point Five's ScratchPad provides numbered lines to hold equations, variable definitions, and so forth, and an output window that shows the results of calculations.

The package contains approximately 150 functions, including ones that cover finance (such as Perpetuity, Present Value, Net Future Value, and Loan Payments) as well as statistical and mathematical functions. *Point Five* can also handle two-dimensional arrays and perform the usual arithmetic expressions on them.

However, the package has significant limitations for scientists and engineers. For example, while *Point Five* will do simple integration using numerical approximation, it will not do differentiation. Limited space is allocated for variables: the maximum size of a table is 5,000 rows, and the total number of elements in an array is 8,000. This is inadequate for many jobs in science and engineering. You cannot create compound statements such as `scatplot(index(n),sin(index(n)))`. It does not support complex numbers.

The on-screen graphics capabilities are also rather primitive. The package permits curve fitting only for polynomial, exponential, and logarithmic functions. You cannot fit a curve to a user-defined function, not even for a single-variable function. In addition, *Point Five* limits you to plotting seven lines per graph, and you're stuck with the default colors and axes. To

make matters worse, the brown color used in plotting is difficult to see on the screen and cannot be changed.

Output is limited. The package supports only Epson and IBM graphics printers, and you must do a screen dump to get a hard copy of your graphics output.

The reference manual is well organized, with reasonable examples, but it lacked explanations for error messages. The help facility was rather clumsy and unintuitive. Luckily, the company's technical support team was knowledgeable.

*Point Five* can be useful to students and workers in science and also to real-estate brokers and small investors. Best of all, it does not require you to become a programmer to take advantage of the computing power of a PC.—Ehud Kaplan

### TK! Solver

The idea behind *TK! Solver* (Tool Kit Solver) is to allow mathematicians and scientists to talk to the computer in the language of mathematics. Instead of having to write programs, scientists can simply enter the equations they want solved. But while this idea is potentially useful, the program is clumsy and difficult to use.

The program consists of eight specialized sheets (some with subsheets) that each deal with different functions and aspects of a problem. The rules and variables sheets contain the various relationships (mathematical expressions and equations) and variables that constitute the model under consideration. A units sheet lets you enter such units as miles per hour; the others are for user-defined functions, plotting, and value lists. The units sheet is particularly useful because it keeps track of the units, letting you know when you try to add, for instance, mph to lbs.

Using these sheets can be difficult because the program forces you to break problems into different facets and put them into different sheets. For instance, if you want to solve an equation such as  $a=x^2$ , the program automatically extracts the  $a$  and  $x$  and puts them into the variables sheet; the operation (multiplication) goes into the rules sheet; and, if you want the answer to be in miles per hour, you must enter that into the units sheet.

The program's commands are cryptic and unintuitive. You switch between the sheets using the ";" key. "=" means select new sheets, and "!!" means calculate. This is not the way scientists work.

*TK! Solver* offers two types of subroutines for solving equations. The direct solver subroutine lets you solve problems using the tedious but safe method of back-substitution for problems in which you have the same number of equations as unknown variables. The iterative solver sub-



### FACT FILE

#### TK! Solver PLUS

OPERATING SYSTEM: IBM PC  
 HARDWARE: 1.0  
 PRICE: \$250  
 CONTACT: UNIVERSAL TECHNICAL SYSTEMS  
 1220 Rock St.  
 Rockford, IL 61101  
 (800) 435-7887 (outside Ill.)  
 (815) 963-2220

#### TK! Solver, Version 1.6

UNIVERSAL TECHNICAL SYSTEMS  
 1220 Rock St.  
 Rockford, IL 61101  
 (800) 435-7887 (outside Ill.)  
 (815) 963-2220

#### List Price: \$250

Requires: 384K RAM (512K RAM recommended), one disk drive, DOS 2.0 or later.  
 In Short: *TK! Solver* allows scientists to solve equations instead of writing programs to solve them. The user interface, however, is awkward. Not copy protected.

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## ■ THE SCIENTIFIC PC

Rule: closing = .82 \* loan + 500

Variable Sheet

Input	Name	Output	Unit	Comment
35000	salary	\$/yr	salary	
33	bracket	%	income tax bracket	
8000	onhand	\$	cash for closing costs, down payment	
25	term	yr	term of mortgage	
10.5	rate	%/yr	interest rate	
70000	house	\$	maximum house price you can afford	
	loan	\$	maximum mortgage allowed by bank	
	closing	\$	closing costs	

Rule Sheet

Rule: closing = .82 \* loan + 500

pit = .28 \* salary "According to the 1987 Tax Law, property tax"

onhand = downpay + closing "is no longer deductible, so for 1987 the"

tax = .825 \* .75 \* house / 12 "savings = ... equation should be modified."

house = loan + downpay

downpay = house \* dpk

payment = loan \* (rate / (1 - (1 + rate)^(-term)))

Ip = payment \* term

Tip = Ip - loan

TK! Solver consists of eight "sheets" that each deal with different aspects of a problem. The rules and variables sheets hold relationships and equations.

routine is useful when the direct solver fails, such as when you have fewer equations than unknown variables; it allows you to supply guesses for parameters of the equation, then finds those values of the parameters that would produce the best solution (in the least-squares sense). The program can solve systems of linear and nonlinear equations.

Unfortunately, the package limits the functions that you can solve. Although engineers will find all the standard operations such as addition, multiplication, exponentiation, and so forth, the program does not provide all the tools necessary for the mathematician. It includes no integrals, differentials, or multidimensional arrays. Because the program lets you combine functions, you could, for example, combine arithmetic functions to create rudimentary integrals, but several of the other packages do integrals automatically.

Graphics are another weak spot in the package. They are difficult to use, unattractive, and inflexible. For instance, you can change neither the axes of the graphs nor the colors.

We saw a new version of the package that should be available by the time this review appears and promises to solve some

of these problems. TK+ comes with a terrific demonstration program and, in addition, includes more interactive help files, more-attractive graphics, and new pull-down menus with self-explanatory options that replace the 1-2-3-style one-line commands of the previous version.

But even the improved TK+ is not an easy program to master quickly. The complexity of navigating among the various sheets takes some time to get used to. Despite the difficulties, I hope that the concept of a model-solving engine is not deserted, and that the company continues the effort required to perfect this intriguing and potentially very useful scientific tool. —Ehud Kaplan

Martin A. Burschka holds a Ph.D. in physics and is a research associate at Rockefeller University. Ehud Kaplan holds a Ph.D. in electrical engineering and is an associate professor at Rockefeller University. Keith Purpura is a graduate student of biophysics at Rockefeller University. Clay Reid is a graduate student of biophysics at Rockefeller University. Ellen Bush has a Master's degree in Chemical Engineering. She is an independent PC consultant.

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# THE SCIENTIFIC PC FASTER CALCULATIONS WITH NUMERIC PROCESSORS

The difference between a PC and a Cray-1 supercomputer comes down to time and money. While you could use the PC to, say, perform complex meteorological calculations normally done on the Cray-1, it might take the PC several years to finish them, and by then of what value would they be? On the other hand, you could use the Cray-1 to balance a checkbook, but does it matter whether your balance comes back in one hundredth or one millionth of a second? And is it worth the cost?

*Adding various accelerator devices can change your 90-pound weakling of a PC into an Olympic athlete competing in the number-crunching game. Sheer power is the point: from spreadsheet applications to CAD to the theoretical sciences, these products reduce the time spent on lengthy calculations.*



The problems facing scientists, engineers, and researchers at companies and universities who must perform many complex calculations under tight deadlines with small budgets also come down to time and money. These people are finding that they must do heavy-duty number crunching in a short time on a PC-sized budget.

Luckily, a number of products such as 8087 and 80287 accelerators, array processors, and a variety of other number crunchers on a card are bringing, maybe not Cray-1, but supermini-level number-crunching power to PCs and ATs for anywhere from a few hundred dollars to \$5,000.

**A MATHEMATICAL SLOUCH** The reason for the PC's lack of mathematical prowess is its design. The PC was intended to be a low-cost, general-purpose personal computer; little thought was given to providing it with real arithmetic processing power. While the AT's numerical prowess is an improvement by virtue of its increased overall speed, it's still no numeric barn burner. Both use general-purpose 8086-family central processing units (CPUs) designed more for adaptability to different types of jobs than for numerical capability.

Realizing from the beginning that its 8086 and 8088 CPUs lacked arithmetic capabilities, Intel designed a numerical assistant, the 8087 numerical processor (NP), which fit into a socket in the PC, XT, and their compatibles. Similarly, the AT and its look-alikes can accept the 80287 numerical processor companion to its 80286 CPU. Now that the price of these chips has dropped below the \$200 range, many people are adding numerical processors to their systems. Besides engineers and scientists, CAD/CAM users are likely to favor the 8087/80287 math coprocessors, since they greatly speed up the calculations needed, for example, to create and rotate three-dimensional images. Spreadsheet and database users are also likely candidates for such products. And as the number of users grows, so does the number of off-the-shelf software packages that can use these chips.

The numerical processor acts much like a pocket calculator to the CPU. For example, to take the logarithm of a number, nor-

## THE LANGUAGE OF NUMBERS

*To understand how numeric processors work, you'll need to know how your PC represents numbers of various sizes and types.*

**P**ersonal computer designers have had to invent various methods for representing and working with positive and negative integers, fractions, and very large numbers. Here is a brief description of how computers and numeric processors work with numbers.

The 16 bits of a word in the PC's memory can represent any integer from 0 through 65,535. These are called unsigned integers. To represent both positive and negative numbers, we use the leftmost bit, normally called the most significant bit, to indicate sign. When the bit is cleared, we assume that the number is positive, when it's set, negative. These so-called signed integers can range from -32,768 through +32,767.

But what do we do when we need to represent larger numbers? We could simply use more bits. For every added bit, the range doubles. For example, 32-bit double integers have an unsigned range of 0 through 4,294,967,296 and a signed range of -2,147,483,648 through +2,147,483,647. When even that is not enough, we keep adding bits to the size of our integer (generally 16 at a time) until the range of representable numbers is large enough for our application.

And what do we do when we need to represent fractions? If we need simple fractions, we could "assume" a denominator (a simple fraction is one in which the denominator is small). For example, let us say we are writing a program that deals with money and the accuracy doesn't need to be greater than one hundredth of a dollar. We can just assume a denominator of 100 or two decimal digits after the decimal point. Thus, a 1 is really \$.01, 2 is \$.02, 100 is really \$1.00, and so on. These are called scaled integers. This system works fine, but the range of representable numbers is small. In our

example program, \$655.35 is the largest monetary sum we could represent.

**INTEGERS** Integers, whether signed or unsigned, single- or double-length, scaled or unscaled, are appealing because they are easy to understand and manipulate; also, they don't require much CPU time to process. There is a strong tendency to stick with integers whenever possible. Even some of the array processors examined in our review work only with integer values.

But integers use quite a bit of memory. And more often than you might think, you'll need a scheme that can handle fractions that are not simple as well as very large numbers. For these applications we use what is called floating point.

**FLOATING POINT** Let me use an everyday example to explain floating point. A calculator has a limited number of digits in its display. For simplicity, my calculator has eight digits and does not suppress leading zeros. I enter a number—for example, 123. When I press the equals key, my calculator displays 00000123. This is analogous to an integer representation. Depress "x squared" (if your calculator does not have this key, just multiply the number by itself). My display now reads 00015129. But when I do it again it reads 2.288664 08. What happened, and what does this mean? When a number gets too large to be displayed in its entirety, the calculator switches to scientific notation to display numbers. My display means  $2.288664 \times 10^8$ . That last symbol  $10^8$  means  $10 \times 10 \times 10 \dots$  eight times, or 1 followed by eight zeros. This system can handle very large and very small numbers easily.

Floating point is very much like sci-



## SPEEDING UP PROBLEM SOLVING WITH PARALLEL PROCESSING

*All of the products reviewed here, as well as a standard PC, use some form of parallel processing to speed up problem solving.*

Individuals usually try to solve problems in a step-by-step, or serial, fashion. So it's not surprising that we impose this serialness on our perception of PCs. In a personal computer with only one processor, a strictly serial view is good enough, but even in a standard PC this is not completely accurate. Besides the 8088 CPU, there is the 8048 CPU in the keyboard, the 6845 graphics processor in the display card, and myriad UARTs, DMA controllers, and the like, all working in concert.

Parallel solutions to problems, though more complicated, are usually faster than serial solutions. In my discussion of the 8087 and 80287 numerical processors, I allude to parallelism by mentioning that while the numerical processor is busy with a calculation, the CPU can continue working as long as it doesn't try to task the NP again until it finishes. Lumping all of our floating-point calculations together at once limits the performance of our system. Better to spread them out, intermingling them with other, nonnumeric operations.

Even microprocessors have long made use of parallel processing. The 8086 family of processors uses what is called a prefetch queue, in which one part of the CPU executes one instruction, while another part fetches the next instruction. In this way, the CPU can keep executing instructions without having to stop to read them from memory. The 80286 and 80386 take this idea even further. Modern processors divide up the task of executing an instruction into several parts. In a technique known as pipelining, one instruction may be executing while a second is being decoded and a third is being prefetched—all in an effort to increase performance.

As an example of the effects of parallelism, I timed two 1,024-point complex

Fast Fourier Transform (FFT) algorithms on a standard 8-MHz AT, once with a standard 80287 and once with a 10-MHz 80287. This is the same algorithm used to test the array processors. The first of these FFTs was written locally in Turbo Pascal. Turbo Pascal tends to task the 8087 NP and then wait for a response before continuing, thus serializing the process. The second was written in assembler by Dr. John Hayes and provided by Hauppauge Computer Works. Dr. Hayes's FFT algorithm tries to maximize the parallelism inherent in the NP/CPU connection. Notice the times in Figure A. Even allowing for overhead due to the higher-level language, the Hayes algorithm is much faster than the serial Pascal algorithm. (Compare these times to those of the array processors, which have even more parallelism due to different architectures.)

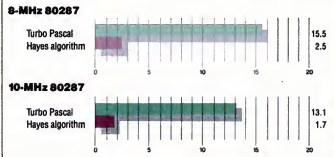
In fact, Hauppauge is planning the introduction of a daughterboard that imparts even more parallelism to the numeric processor. This card will plug into the

80287 daughterboard slot, but will contain multiple 80287s. The CPU will be able to task each 80287 with a separate calculation to work on simultaneously, increasing numeric performance.

All of the array processors tested except one do not interfere with the host PC while they crank out their solutions. This creates many opportunities for parallelism, since you can insert more than one array processor of the same type into the same host. In such a system, the AT could break the problem into three parts, sending the first part to the first array processor, the second to the other AP, and working on the third part itself.

Similarly, many accelerator cards do not disable the host in which they reside. This allows several operations to continue at once.

The moral to this story is that when one numerical processor or array processor is not fast enough to handle your problem, try two or three. By dividing up your problem into parts, you can whittle it down to size.—Stephen Randy Davis



**Figure A:** The measurements for a 1,024-point complex Fast Fourier Transform (FFT) algorithm were made on an 8-MHz AT equipped with either a standard 80287 or a 10-MHz accelerated 80287. The parallel processing (Hayes) achieves a result six to eight times faster than serial calculation (Turbo Pascal). All times are in seconds.

## ■ THE SCIENTIFIC PC

both of which are designed specifically for cranking out calculations on large strings of numbers.

Unfortunately, although many software packages have drivers for 8087/80287 numerical processors, you can't buy off-the-shelf software that uses array processors. Since you have to write your own software for your application (which isn't necessar-

■ **Non-Intel-compatible accelerator cards do not run PC-DOS-compatible programs, and therefore have no effect on "normal" software.**

ily a problem for the engineers and scientists who need this type of computational power), it's crucial to consider not only the card itself but the software development support that comes with it. In the article, "Numeric Muscle for the PC," we review six array processors from Sky, Marinc Computer Products, Data Translation, and Systolic Systems, exploring their software support as well as their relative strengths and weaknesses.

**ALTERNATIVES TO INTEL** Although array processors are probably the last word in repetitive computation, some number-crunching problems are not of this type. For instance, you might need to perform many calculations on a small set of numbers. For such nonarray problems, you can either add an 80286-compatible accelerator card or a card based on a CPU not belonging to Intel's 8086 family to achieve faster performance. Both options involve adding a separate computer-on-a-card to your PC. Intel-compatible accelerator cards were covered earlier in the article "Accelerator Boards: Power for a Price" (*PC Magazine*, Volume 5 Number 15). In this issue we take a quick look at accelerator cards that do not use the Intel 8086 family of CPUs—the so-called non-Intel-com-

patible accelerator cards.

As noted in Volume 5 Number 15, 8086-compatible accelerators replace the host computer's CPU with a faster unit. In return these cards automatically accelerate all PC-DOS software. Non-Intel-compatible accelerator cards do not run PC-DOS-compatible programs, however, and therefore have no effect on "normal" software. To leave the host computer usable, these cards do not replace the 8086-compatible CPU but simply add a second processor. Since PC-DOS software does not know about this second processor, it is not affected. As with array processors, you'll have to write your own software to take advantage of these cards.

Why, then, would anyone choose these cards over Intel compatibles, given such an extreme disadvantage? Designing CPUs inevitably involves making compromises. The compromises that Intel made in its 8086-family processors—in particular the 64K segment limitation that is imposed to help manage memory—make it poorly suited for problems requiring calculations on the huge numbers or on the huge amounts of data that are typically processed in many scientific and engineering applications. CPUs made by other manufacturers—for instance, the Motorola 6800—have no memory management and segment limitations and are therefore more adept at solving such problems. Additionally, the 8086 is very old as CPUs go. As technology improves, so does CPU performance.

*PC Magazine* examined plug-in cards from Definnicom, Opus, and Immos based on the Motorola 68020, the National Semiconductor 32032, and the Immos T414 processors. You'll find reviews of these cards in "Changing the Rules of the Game."

While the PC, XT, and AT may not be the first names to pop into your head when you think of raw number-crunching power, you can add cards and chips to give them the power they need to conquer just about any numerical job you encounter. A properly equipped PC could even finish those meteorologic calculations in time for the evening weather report.

*Stephen Randy Davis is a frequent contributor to PC Magazine.*

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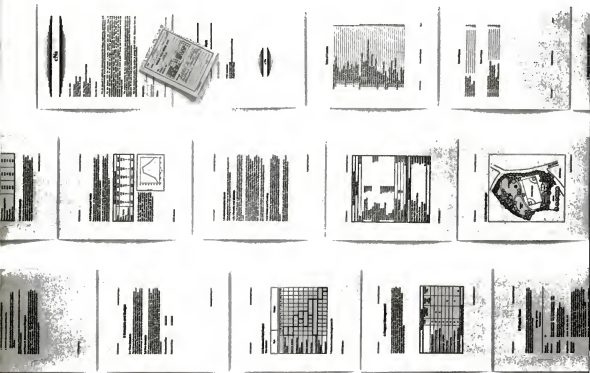


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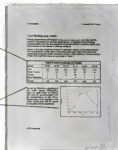
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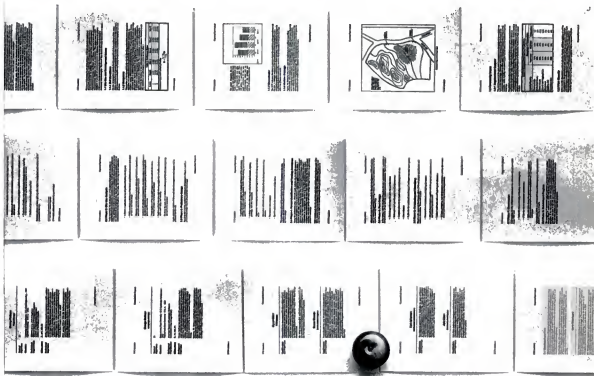
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# CLOCKING THE 80287 AT HIGH SPEED

*Of all the methods for speeding  
up the PC's number-crunching capabilities,  
80287 accelerators are the  
most accessible to the average PC user.*

Many off-the-shelf software packages support the 80287 numerical processor. Therefore, you'll find that adding a numerical processor to your PC will improve performance for many software packages that rely on extensive calculations, such as CAD/CAM packages, databases, and spreadsheets. If you need speed beyond what you gain with an 80287, there are products on the market that can appreciably increase its calculation speed. Accelerators for the 80287 are fairly easy to install and are much less expensive than other acceleration alternatives.

To understand exactly what these accelerators do, you first need to understand just how the 8087 and 80287 math coprocessors work, and also how they differ from each other.

The 8087 adds some 68 numeric instructions and eight 80-bit registers to the

base 8086 or 8088 central processing units. To give you an idea of the type of improvement you can expect from the numerical processor, the 8087 performs IEEE (Institute of Electrical and Electronics Engineers) Floating Point Standard 754 arithmetic up to 100 times faster than the CPU alone (see sidebar "The Language of Numbers" for an explanation of floating-point numbers).

The 8087 has a unique and intimate relationship to the 8086, since it is wired directly to the 8086's data and address lines. The 8087's job is to perform calculations only; the 8086 acts as a messenger, bringing instructions and data from memory to the 8087 for its calculations and taking results from it. This scheme effectively prevents duplicate circuitry on the two chips: Since only the 8086 needs addressing circuitry, the 8087's circuitry can be fully devoted to performing calculations. The pro-

cess works this way: as the 8086 fetches instructions to be executed, the 8087 examines each one, ignoring normal 8086 instructions. Only when the CPU fetches an instruction beginning with the 5-bit sequence 11011—which is the so-called escape sequence—does the 8087 math coprocessor go to work executing the numeric instructions. This tight coupling of processor and coprocessor makes the pair appear to the programmer almost as if it were only one chip.

Of course, the 8087 takes a certain amount of time to perform its calculations. Just as with the CPU, this time is measured in clock cycles. Although the CPU is perfectly free to continue executing other, nonnumeric instructions while the 8087 is busy, the CPU must wait for it to finish before tasking it again. Increasing the clock speed improves the 8087's performance in the same way and by the same amount as the CPU's.

Software compatibility with existing 8086 software was an important consideration when designing the next-generation 80286 microprocessors. Therefore, the 80286's own numeric processor, the 80287, is very similar to the 8087. Benchmark tests designed for the 8087 run in roughly the same time on the 80287. Both chips consist of two separate parts: the Bus Interface Unit (BIU) and the Execution Unit (EU). In the 8087 these two parts are closely tied, making this division invisible to the programmer. In the 80287, however, the two units are tied loosely so that the BIU and EU can be driven independently. Although the BIU must be driven with the same clock as the 80286 for the two to communicate properly, the EU can run at a higher clock speed, resulting in quicker execution.

Much as owners of the original 6-MHz AT found that they could achieve better performance by inserting a faster crystal to run their 80286 at a higher clock rate, engineers found that they can use the same trick for the 80287. Increasing its clock rate means the 80286 does not have to wait as long for the results of the 80287's numeric calculations.

The following are reviews of the Xcelx and the Fast-10, two 80287 accelerators that use this principle to improve numeric performance significantly.

## Ariel Xcelx

The Xcelx is more than an 80287 accelerator. When it became known that you could make a 6-MHz AT run at 8 MHz by adding a new crystal, IBM decided to equip its newer 6-MHz ATs with a new BIOS routine that checked the clock speed at power-up. If it was not 6 MHz, the unit refused to boot up. Ariel Computer Corp. designed the Xcelx to circumvent this "anti-speed-up" ROM. When installed, the Xcelx provides a dial on the back of the AT that lets you select the 80286 clock speed. No matter what speed you select, however, the Xcelx runs the 80286 at 6 MHz for the first 25 seconds after power on—roughly the time it takes to complete the boot-up process. Since this means that Ctrl-Alt-Del no longer reboots the AT properly, a reset switch is provided to take its place.

Besides increasing the 80287 clock speed by speeding up CPU clock speed, the Xcelx allows you to set the numeric processor's speed independently. You can

use copper straps provided on the unit to set the 80287 to run at 8, 10, 12, 14, or 16 MHz. You can also purchase a version of the Xcelx, called the 287 Express, that is functionally identical to the one reviewed

here but furnishes only 80287 acceleration. The Xcelx does not come with an 80286 or 80287 because you can use off-the-shelf chips with the unit. Ariel also sells faster 286s and 287s to allow the highest possible clock speeds.

Installation of the Xcelx was slightly intimidating at first: the unit comes in three parts, with assorted clips. But it turned out to be easier to install than I thought. Except for a slight overlap of the speed selector plate with a mounting screw on the back of the AT, I had no trouble with the first step of installation. Next, you stick the master module onto the side of the power supply with some double-sided tape. Although this blocked some of the power supply's air vents, enough remained clear to maintain proper cooling. Finally, you insert a small daughterboard into the 80287 socket. Surprisingly, this was the most difficult step of all because the skirts of the card blocked the socket, making it difficult to align pins and holes.

Attaching the two clip wires was much easier than expected, since the connections

## PC MAGAZINE FACT FILE

### Ariel Xcelx

Ariel Computer Corp.  
P.O. Box 866  
Flemington, NJ 08822  
(201) 788-9002

**List Prices:** Xcelx, \$99.95; *Speed Utilities*, \$39.95; higher-speed 80287s (48-hour burn-in with 2-MHz overrating): 8 MHz, \$359.95; 10 MHz, \$399.95; 12 MHz, \$499.95; 14 MHz, \$599.95; 16 MHz, \$699.95.

**In Short:** A double-duty accelerator that can set the clock rate of the CPU and of the 80287 separately. The Xcelx can set the 80287 to run at 8, 10, 12, 14, or 16 MHz, although for the 14- and 16-MHz speeds you must purchase a specially selected 80287 chip from Ariel.

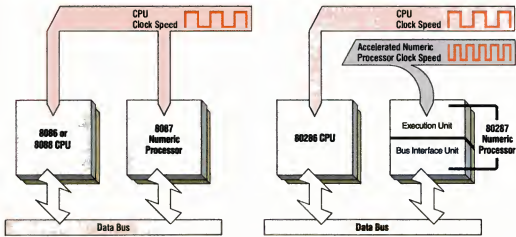
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## PC MAGAZINE Independence Equals Speed

Since the 8087 clock is wired directly to the 8086 (or 8088) data and address lines, it must therefore be in lock step with the 8086/88 clock in the PC. You can't accelerate the 8087 beyond the speed at which the CPU runs.

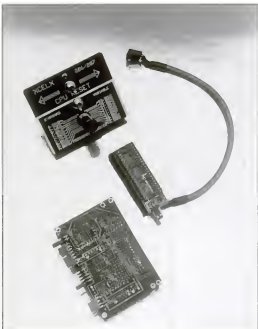
In the 80287 the two major components of the chip—the Bus Interface Unit (BIU) and the Execution

Unit (EU)—can be driven independently. In order to communicate with the CPU, the BIU must be driven at the same clock speed as the 80286. However, the EU can run at a higher clock speed, resulting in quicker execution of calculations. Separating these functions frees the 80287 from the limitations of the 80286 clock speed.





## ■ THE SCIENTIFIC PC



*The Xcelx speeds up processing two ways: its dial lets you select 80286 clock speed; copper straps on the unit itself let you set the 80287 to run at 8, 10, 12, 14, or 16 MHz.*



*The Fast-10 does one thing—it speeds up the 80287 from its normal 5.3 MHz to 10 MHz. The product consists of a daughterboard only slightly larger than the processor it carries.*

### ■ Ariel advises that you can run the 80287 safely at 30 percent faster than its rated speed.

were very accessible. All that remained was to connect the three units together via the supplied cables. Although not difficult, this step could have been made much easier by better placement of the connectors. (Ariel claims that the newest revision of the card has better-placed connectors and a transparent daughterboard designed for easier installation, however, this was not available in time for review.)

The manual was adequate, but it could have used larger, clearer diagrams. In any case, the finished product worked the first time, which means a lot.

Ariel sent us its optional *Speed Utilities* for this review. These utilities include a disk interleave utility to improve disk transfer times. They also offer a TUNEUP utility that measures the execution speed of the 80286. Since the Ariel card has features for controlling both the CPU speed and the 80287 speed, we used the TUNEUP utility and the card to set a standard speed of 8 MHz on the CPU. We then used the card's 80287 adjustment features to vary the speed of the 80287 and ran the PC Labs Floating-Point benchmark test.

Although exceeding specified ratings by too much can permanently damage the 80287, the 80287 is conservatively rated. This is true for most microcomputer components. Ariel advises that you can run the

80287 safely at 30 percent faster than its rated speed. We therefore tested our stock 80287-3 (5 MHz) at 8 MHz. We used a higher-speed 80287-10 (10 MHz) to test the Xcelx, running as high as 12 MHz. The benchmark test shows results for floating-point calculations with the Xcelx running at 8, 10, and 12 MHz. Ariel claims that you can also run the 80287 at 14 and 16 MHz. To do so, Ariel provides hand-selected 80287 chips and advises you to use special heat sinks. The results of our tests appear in the chart, "PC Labs Benchmark Tests: 80287 Accelerators."

### Hauppauge Fast-10

The Fast-10 from Hauppauge Computer Works does only one thing. It speeds up the 80287 from its normal 5.3 MHz to 10 MHz. That's all it does. The Fast-10 consists of a daughterboard only very slightly



## Benchmark Tests: 80287 Accelerators

All tests were performed using an IBM PC AT running at 8 MHz. We replaced the standard 80287-3 (5 MHz) chip with the higher-speed 80287-10 (10 MHz) chip for one iteration of the benchmark testing (the Xcelx running at 12 MHz). Ariel claims that the Xcelx can also run the 80287 at 14 and 18 MHz but requires hand-selected chips to do so.

The initial speedup is the most dramatic—the 80287 performs the test more than 10 times faster than an unaided 80286. This is in part due to the fact that the circuitry on the 80287 is wholly devoted to calculation, while the 80286 continues to perform other functions not directly related to the numeric calculation. The speed improvements of the Xcelx board are directly related to the clock speed at which it is set to run. When set at 12 MHz, the Xcelx improves upon the 80287 speed by 33 percent.

(Times given in seconds)

Product	Floating-Point Calculation
80286	35.8
80287	3.3
Hauppauge Fast-10 (10 MHz)	2.4
Ariel Xcelx (8 MHz)	2.8
Ariel Xcelx (10 MHz)	2.5
Ariel Xcelx (12 MHz)	2.2

The Floating-Point Calculation benchmark test measures processor speed by looping through a series of floating-point calculations, including multiplication, division, exponentiation,

and logarithmic and trigonometric functions. The benchmark program uses the floating-point library included with Microsoft C Compiler 4.0.

larger than the 80287 processor that it carries. The crystal and clock chip are tucked up underneath the 80287. This makes installing the Fast-10 no more difficult than

installing the 80287 processor itself.

As simple as installation is, Hauppauge supplies a disk containing a diagnostic utility to verify that the Fast-10 is working properly and to measure its speed. The remaining space on the disk contains several demo programs of analytical software available from Hauppauge. After spending a little time with these demos, I can heartily recommend Hauppauge's inexpensive HFT+ utility for learning more about time domain versus frequency domain representations of functions.

See the benchmark test results for floating-point calculations. The Fast-10 is a simple but effective replacement for a standard 80287.

*Stephen Randy Davis is a frequent contributor to PC Magazine.*

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## FACT FILE

**Hauppauge Fast-10**  
Hauppauge Computer Works, Inc.  
358 Veterans Memorial Hwy.  
Commack, NY 11725  
(800) 443-MATH  
(516) 360-3827

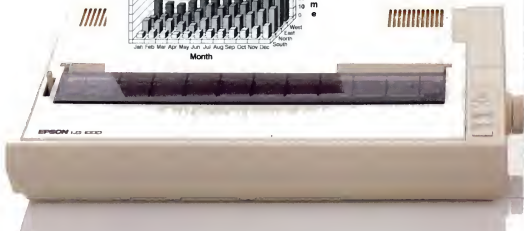
List Price: Fast-10 (including 10-MHz 8087), \$469.

In Short: The Fast-10 does only one thing: it speeds up the 80287 to run at 10 MHz.

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# OTHERS PALE B

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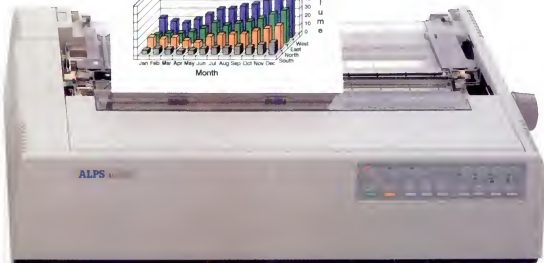
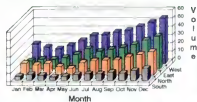
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# NUMERIC MUSCLE FOR THE PC

*Array processors are designed  
to perform a limited set of calculations  
on enormous amounts of data.  
The major drawback: lack of off-the-shelf  
software to run them.*

**A**rray processors (APs) are the champion number crunchers of the personal computer world. Often expensive and useful only for people willing to write software for number-crunching applications, what they lack in breadth they gain in depth.

These number-crunching demons are most useful for applications that require relatively few calculations on immense amounts of data. A particularly apt application for an array processor would be, for example, the types of simulations that auto manufacturers perform to test new models in a crash. In such a simulation, you perform a few calculations based on basic laws of physics on a large number of points on the surface of the car, repeating them to show what happens when the car moves.

To give you an idea of the types of APs that are available for the PC and AT and what they are capable of, *PC Magazine* reviewed APs from four manufacturers. But

first you need to understand some of the issues that pertain to APs.

The most obvious consideration is the card itself. Some APs have a standard 8-bit PC bus, while others opt for the wider AT bus. If you are planning to use a PC host, be sure not to purchase an AT-based card. All of the PC-based cards tested were built compactly enough to be installed into an AT connector. Most of the cards tested required only one slot. A few of the cards were either of the double-decker variety, with two cards bolted together, or had such large heat sinks that they extended over into the next card slot area. Make sure that sufficient room is available.

**SOFTWARE LIBRARIES** Programming an AP is a complicated task. If you're just interested in multiplying two arrays together as part of solving a problem, you probably won't be too excited about having to learn the details of the

AP's internals. To help users get around this problem, all of the APs tested included software libraries. These libraries define subroutines that can be called from a high-level language (HLL) such as FORTRAN or Pascal to perform common functions. The subroutines allow a programmer to control the AP without getting involved in all the pesky internal details.

For example, to multiply two arrays, I might call a routine with a name such as VMULT, passing it the two arrays and their length. Although this subroutine is called like any other, its purpose is not to perform the multiplication but to task the AP card to do it. When the subroutine returns, the caller is not assured that the multiplication has been performed—only that the AP has in fact been tasked. The library normally contains control routines, such as APWAIT, to test the AP for the completion of an operation. As with the numerical processor, the host computer is generally free to continue on while the AP works on its problem.

These high-level language libraries provide the AP's interface to the host. It is vital that these libraries be well thought out and well documented. Because you'll find different subroutines in different libraries, you should carefully examine the libraries that come with an array processor to make sure they suit your needs. Some AP manufacturers offer several different libraries, each specializing in a different area, which is a very positive feature. Many of the systems also come with diagnostic tests that verify whether the processor is operating correctly.

**PROGRAMMING AN AP** There will be times, however, when you'll want to use your AP to perform an operation of your own invention. Most APs offer at extra cost a microprogramming package that allows you to program the AP yourself. But not all of these packages are equally easy to use. Remember that programming an AP is more difficult than programming a general-purpose computer. You'll need a great deal of support to write your own routines successfully. In order to be used seriously, a microprogramming package must provide at least an assembler and a debugger capable of single stepping microinstructions.

Since it is sometimes difficult to design AP hardware to allow for breakpoints and single stepping, some manufacturers include software simulators of their cards on which to develop AP routines. If these simulators accurately model the AP, a programmer can use them to debug AP routines without using the hardware itself. This can result in significant cost savings if large numbers of programmers are involved in a project, since not every programmer will need an AP of his own. If you ever expect to program the AP on your own, you should carefully consider the microprogramming support package.

**LANGUAGE SUPPORT** Different high-level languages require different interfaces to their subroutines at the machine language level. It is, therefore, impossible to write a set of subroutines that can be called from every language. While some AP manufacturers support just one language, others support multiple languages by offering several similar libraries, each meant to be called from a different language. If you want to call a routine meant for IBM FORTRAN from Microsoft C, for example, it is not terribly difficult to write a set of assembler routines to make the interface work properly. But doing so is a nuisance;

so it's better if an AP comes with support for your language.

**WORD SIZE AND FORMAT** Another consideration when comparing APs is the word size and format. Most real-world measuring devices generate integer data. For those operations that do not need the tremendous range of floating-point numbers, it is better to process such data as integers (see sidebar "The Language of Numbers"). APs that don't have floating-point capability may be perfectly acceptable for these types of applications. However, even if the input data is integer, there



## Array Processors: Summary of Features

Product Manufacturer	Sky 321-PC AT Model 3261 Sky Computers Inc.	APB-3016PC Mannco Computer Products	APB-3024AT Mannco Computer Products	PC100-32 Systolic Systems Inc.	PC100-64 Systolic Systems Inc.	DT7010 Data Translation Inc.
Base price	\$2,300	\$2,995	\$3,995	\$4,240	\$4,485	\$4,995
Bus connector	PC	PC	AT	AT	AT	PC
No. of slots required	1	1	1	2	2	2
<b>SOFTWARE SUPPORT</b>						
Multiple software libraries available		●	●			
No. of high-level languages supported	1	1	1	7	7	5
Diagnostics	●			●	●	●
<b>MICROCODING TOOLS</b>						
Microassembler	●	●	●			●
Microdebugger	●	●	●			●
Simulator						●
<b>WORD SIZES (bits)</b>						
Integer	16	16	16	N/A	N/A	N/A
Scaled integer	N/A	16	16	N/A	N/A	N/A
Floating point	N/A	N/A	24	32	64	32
<b>INTERNAL ORGANIZATION</b>						
Central processing unit	Texas Instruments T3C2910	American Microdevices AM29116	American Microdevices AM29116	None	None	American Microdevices AM2910A
Numeric processor	None	Wetec WTL1516	Wetec WTL1516	Wetec WTL1602	Wetec WTL1164	American Microdevices AM29325
Data area	64K × 16 bits	8K × 16 bits	8K × 24 bits	Depends on application	Depends on application	8K × 32 bits
Program area	4K × 16 bits	2K × 48 bits	2K × 48 bits	0	0	2K × 56 bits
Stores code in ROM chips	●	●	●	N/A	N/A	●
Amount of host memory space required	128K	Two 16K areas	Two 16K areas	0	0	32K
User-definable placement in memory	●	●	●	N/A	N/A	●

—Indicates Editor's Choice ● —Yes —No N/A —Not applicable; does not have this feature

## ■ THE SCIENTIFIC PC

will be times when repeated operations will make the resulting integers either underflow or overflow (that is, become too small or too large to be representable). The ability to automatically scale integer calculations during processing to avoid such problems is a big advantage for integer cards.

Just as important as format is the data size. A 32-bit integer can represent a much larger number than a 16-bit integer, so there is much less chance of overflow. Similarly, a 64-bit floating-point number has very many more digits of accuracy and a larger range than a standard 32-bit floating point. Unfortunately, it takes longer to process those extra bits, and performance suffers. If you do not need the accuracy and/or range of double-precision floating point, you might be better off with the faster, less accurate single precision.

**USING MEMORY** All of the cards tested map their own memory into the PC's memory space somewhere. For the AP to work properly, there can't already be memory at the same location. To avoid this, you should be able to select the address of the AP. When adding an AP to an existing PC, it is much easier to change the card to fit the host than to reconfigure the host to accommodate the card.

Most APs maintain their own data memory. This allows for faster access during calculations, but it also means that data must be transferred to the card for processing and back to the host when processing is completed. The time it takes to do this is called the transfer time. Cards that use the host's memory have zero transfer time, but may not operate as fast. In the final analysis, it is the overall time that's important, so when reading published performance specifications, look to see whether they include transfer time.

Each of the cards stores its on-board microcode in very fast RAM within the card. Since this RAM is not saved at power down, the host computer must reload these cards from disk before you can use them. This did not present a problem with any of the cards tested. Since some applications may require "turnkey" operation without loading from disk, some of the APs tested allowed you to replace the RAM with ROM containing the card's microcode.

The card will still have to be initialized, but the AP won't have to access the disk. If a card also requires loading other tables, which some do, and if these cannot be stored in ROM also, then it makes little difference whether the microcode is in ROM or not. This is an important point if you desire "turnkey" operation.

Since numeric processing speed is the primary reason for purchasing an AP, a comparison of performance was a must. Because all of the APs were accessed differently, after careful consideration we decided that the fairest performance test was the 1,024-point complex Fast Fourier Transform (1K FFT). This algorithm is commonly used by scientists to find cycles in data. We chose the FFT for our testing for several reasons. First, it is well known. Had we simply invented an algorithm, resulting times would have meant little to readers. Second, it is a commonly performed operation and its time is, therefore, of some importance. Third, the FFT allows for a great deal of parallelism. The more that an AP card can do at one time, the better it will fare in the FFT. Finally, because it is such a common operation, all of the cards tested provided support for the 1K complex FFT.

Much thought was given as to whether the real FFT, which is an FFT of real numbers rather than complex numbers, was not a better test. The primary argument favoring the use of the real FFT was that laboratory data is more often real integers than complex. However, not all of the card manufacturers reviewed provided separate real FFT algorithms (a real FFT can always be performed using the complex FFT algorithm). The idea was to compare the capability of the cards, not whether the manufacturer had included a specific algorithm or not. However, since measured data is so often real, we noted whether the manufacturer provides optimized real algorithms.

We measured the times for the FFT on an 8-MHz IBM PC AT with a 30-megabyte hard disk and 512K of memory. All measurements were made with a stopwatch by performing enough FFTs to have the total time exceed 10 seconds. Times listed are per FFT. Although included in the FFT time, the transfer is also broken out separately. We could not directly mea-

sure transfer times, but got them from documentation supplied by the manufacturer.

## Data Translation 7010

The Data Translation 7010 array processor is a surprising card. It must be the strangest-looking card I have ever seen. The Am29325 arithmetic unit, located towards the rear of the card, has a gigantic heat sink—almost the size of a deck of cards—sitting atop it. This heat sink protrudes into the adjoining card slot, far enough back that it would not interfere with a half-card in that slot. I checked it after a few minutes' operation and it does get hot, however, I purposely left the card operating for an extended period with the AT's top removed and experienced no problems. Data Translation is expecting a CMOS version of the 29325, which will make a greatly reduced heat sink possible.

Once you get past its strange appearance, the DT7010 is an admirable card. Even though it supports only floating point, the DT7010 card was the fastest floating-point card tested, faster even than most integer cards. And it accomplishes this with a PC bus! The DT7010 gains much of its speed from using a very large instruction word (56 bits). Each instruction contains command fields for six different processors on the card. It is therefore possible to perform several different operations in one clock cycle. In addition, the



## FACT FILE

### Data Translation 7010

Data Translation Inc.  
100 Locke Dr  
Marlboro, MA 01752  
(617) 481-3700

List Prices: DT7010 array processor, \$4,995; MACH Subroutine Library, \$1,495; MACH Microcode Assembler and Simulator, \$1,495; MACH Subroutine Library with Microcode Assembler and Simulator package, \$2,495; user manual without board or software, \$95.

**In Short:** The DT7010 only does floating-point calculation, but it was the fastest floating-point card tested. It comes with a useful diagnostic disk, and its documentation is clear and well indexed.

Circle 1600 on Reader Service Card



*The fastest floating-point card tested was the Data Translation 7010, faster even than most integer cards. It gains much of its surprising speed from its use of a very large (56-bit) instruction word.*

architecture includes four pipeline registers, which are used to prefetch or get new instructions ready from the on-board microcode storage area while the processor is working on different ones.

Included with the card is a diagnostic disk containing a single program, **TEST**. This program presents a menu of tests that you can run when you unpack the card. These are the same tests that the company runs before shipping, so you can use them to test for any damage during shipping. You should keep this disk in a safe place in case the card develops problems.

Although the DT7010 appears within the host's address space, you can strap it to any 64K address within the first 1 megabyte. After selecting a hardware address that does not conflict with the host, you follow a simple procedure in the manual to install the software at that address. Although, theoretically, you could install multiple DT7010s in the same host (at different addresses), Data Translation's software package does not support this.

Optional, but a must purchase, is the **MACH Subroutine** library. Different versions of this library provide support for Microsoft FORTRAN, IBM Professional FORTRAN, Ryan-McFarland FORTRAN, Microsoft C, and Lattice C. An introductory manual gives you an overview of the library's capabilities and a good feel for the card itself. A separate manual that comes with the library documents each routine, listing the calling sequence, explaining its function, and giving its execution time on both a PC and AT. The system comes with routines for performing most real and complex matrix operations.

To use the library, the calling program must initialize the card by calling the control routine **APINIT**. This routine loads the DT7010's microcode from disk into its code memory. Once this routine is completed, the calling program can call any of the other routines in the library. The special routine **APWAIT** ensures that the operation is completed by not returning to the calling program until the DT7010 is idle. You shut down the card at the end of the calling program by calling **APEXIT**.

A separate package, the **MACH Microcode Assembler and Simulator**, allows you to program the card and includes a 43-page **Principles of Operation** section describing almost every aspect of the card's architecture. The simulator comes in a library, much like the high-level language support libraries. However, this library is not built to access the DT7010, but rather to emulate it by performing the AP functions in software. This simulator is combined with the debugger to allow the programmer to test microcoded routines on any PC compatible without using the DT7010 itself. The debugger supports single stepping, breakpointing, examination of flags and registers, and so on. This appears to be a quality package for microcode development.

Although more expensive than most of the other cards tested, Data Translation's DT7010 is a class act. The documentation is clear and well indexed. The excellent diagnostics make the card easy to operate. Finally, it had one of the best times on the 1K FFT performance test. And the real FFT algorithm provided was even faster. You can't get much better than this.

## Marinco APB-3016PC Marinco APB-3024AT

Marinco Computer Products markets three array processors for PC compatibles: the PC-based APB-3016PC and APB-3024PC, and the AT-based APB-3024AT. In addition, Marinco makes available special versions of the 3024 for the AT&T 6300 and the Olivetti M24. We reviewed the 3016PC and 3024AT (the 3024PC is functionally identical to the 3024AT). The 3016 is a conventional 16-bit integer array processor. The 3024 was the only AP tested that had both 16-bit integer and floating-point capability, the latter using a Marinco 24-bit format.

Having both formats available in one AP can be a great advantage if you want to use the AP for a variety of applications. As noted earlier, integer operations are often much faster than floating point, and this case was no exception. Notice in the per-



### FACT FILE

#### Marinco APB-3016PC

#### Marinco APB-3024AT

Marinco Computer Products

5452 Oberlin Dr.

San Diego, CA 92121

(800) 421-4807

(800) 421-4808 (in Calif.)

**List Prices:** APB-3016PC, \$2,995; APB-

3024AT, \$3,995. **Single-Precision Vector li-**

**brary:** software with source code, \$1,200;

executable code only, \$400. **Extended-Preci-**

**sion Vector library:** software with source

code, \$1,500; executable code only, \$500.

**Signal-Processing library:** software with

source code, \$1,500; executable code only,

\$500. **Executive Utility library:** software with

source code, \$1,200; executable code only,

\$400. **Graph/Plot library:** software with source

code, \$900; executable code only, \$300.

**HIAASM, high-level assembler package** (in-

cluding development software, **APMKN**

window-based monitor/debugger, **Executive**

**Utility library:** with source code, \$8,700;

with executable code only, \$2,900.

**In Short:** This array processor was unique in

that it was the only one tested that had both

floating-point and integer capability, which

is useful if you want the array processor to al-

low you to handle a variety of applications.

Unfortunately, the card does not include a

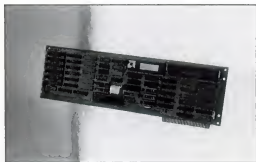
true diagnostic test, and the quality of the

documentation is inconsistent.

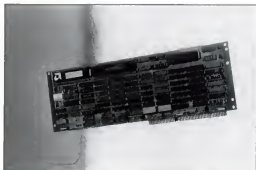
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## ■ THE SCIENTIFIC PC



*The Marinco APB-3016PC is a conventional 15-bit integer array processor. The card is equipped with a program that performs sample calculations but lacks a true diagnostic program to verify its operation.*



*The Marinco APB-3024AT was the only array processor tested that had both a 16-bit integer and a 24-bit floating-point capability. Marinco markets an optional debugger and high-level assembler to support microcoding of the 3024.*

■ Marinco's mix-and-match philosophy allows you to match the required software with the proper hardware.

formance tests that the integer FFT times for the 3024 are one-third those of the floating point. Marinco supplies even faster FFT algorithms for real input—the DT7010 was the only other card to do this. The only reservation is whether Marinco's 24-bit floating point has sufficient resolution and range.

The 3024's program and data memory were independently strappable to any 32K

boundary. The 3016 required a PAL (programmable array logic) modification at the factory to change program and data memory. Unfortunately, while the cards come with programs that perform sample calculations, neither card came with a true diagnostic test program to verify its proper operation.

The quality of Marinco's documentation is inconsistent. Some of the diagrams appeared to be reductions of larger sheets and were too small to be read clearly. The Hardware Reference section describes the AP card purchased. Each optional library, which includes the *Single-Precision Vector*, *Signal-Processing*, *Extended-Precision Vector*, and *GrafPak* libraries, comes with its own documentation. Source code is also available for each.

To use the card, the user code first initializes the address of the cards in software with the SETAPB call and then loads the microcode contained in two different files via the QLOADP call. Finally, something

called the Omega table must be loaded using the special LODOMEGA call. At this point, you can use the card until you shut off the PC's power. Although it uses a longer process than some other cards, the advantage is that you need only initialize the Marinco card once. And to make things a little easier, Marinco has provided examples for you to copy.

Marinco markets a separate high-level assembler, called HIASM, to support microcoding of the 3016 and 3024. HIASM, while not truly a language like Pascal or BASIC, does appear to be easier to use than most assemblers. To support it, Marinco markets a window-based monitor/debugger known as APMON. This monitor allows access to the registers on the card as well as supplying breakpoints and performing other functions. I can't imagine anyone purchasing the assembler without the debugger.

I very much like Marinco's mix-and-match philosophy, which allows you to match the required software with the proper hardware. Marinco's cards turned in excellent performance test times. If you need either a fast integer card or an integer/floating point switch-hitter, there is a Marinco card for you.

## Sky 321-PC/AT Model 3261

Sky is one of the older names in array processing. The company makes APs for many different computers. The 321-PC/AT Model 3261 is the PC version of



### FACT FILE

#### Sky 321-PC/AT Model 3261

Sky Computers, Inc.  
Foot of John St.  
Lowell, MA 01852  
(617) 454-6200

**List Prices:** Sky 321-PC/AT Model 3261, \$2,300; optional C Compiler, Model TCNCB-0, \$500.

**In Short:** The 321 is designed to work with Sky or other analog-to-digital data collection cards and can process the data coming from them in real time.

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## Performance Tests: Array Processors

We tested array processors using the 1024-point complex Fast Fourier Transform (1K FFT) algorithm, which is an algorithm commonly used by scientists. This algorithm is used to determine the cycles in data—for instance, the cyclical nature of stock prices. Although the 1K FFT is numerically intensive, the execution time is basically insensitive to variations in the data. Therefore it makes little difference in execution time if the data consists of all zeros or widely different numbers.

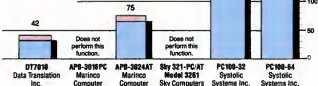
The testing environment consisted of an 8-MHz IBM PC AT with a 30-megabyte hard disk and 512K of memory. The result, given in milliseconds, represents the execution time per FFT. All measurements were made with a stopwatch. In order to be able to time the operation, we made sure that the total number of executions gave a result in excess of 10 seconds; we then divided the result by the number of executions.

Each bar in the chart indicates the average time for the operation, which includes both the calculation and the transfer time between the array processor and the host CPU. Transfer times could not be measured directly, but were derived from the documentation supplied by the manufacturer. You'll notice that the two products from Systolic Systems show a transfer time of zero. These cards rely on the CPU and memory of the host computer. As a result, their execution times are more than four times slower than those of the other cards tested. The only advantages are that by using the host's memory, the Systolic products avoid conflicts with already installed memory and don't require separate programming languages.

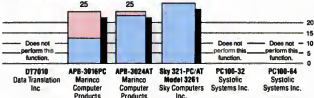
All of the cards tested support the 1K complex FFT; however, only the Marinho APB-3024AT supports both floating-point and integer calculations. Products such as the DT7010 from Data Translation that are capable of parallel processing will have much faster execution times for the algorithm. Keep in mind that test results for floating-point and integer calculations are not comparable.

### 1K FFT Floating-Point Calculations

■ Calculation time  
■ Transfer time  
(Times given in milliseconds)



### 1K FFT Integer Calculations



Sky's family of 16-bit integer, digital-signal processing cards.

The 321 is different from the other cards tested in that it is designed to work with the Sky analog-to-digital (or similar) data collection cards. The 321 card can process data from the data collection card in real time. A 10-megabyte-per-second alternate input and output bus, which allows input and output processing to be handled as a continuous process, is located on the top of the 321. You use an included ribbon cable to connect this bus to the data collection card. As a result, even though each Sky microprogram can perform only one function, the Sky card is able to accept entire program ROMs. If you would like to

perform more than one operation, you can "cascade," or hook, multiple 321 cards together.

For performing more typical AP applications, the 321 can be fed data via the PC bus just like the other cards tested. In this mode, the 321 forms a nice integer-processing card.

Unlike other array processors that come with one or very few microcode libraries, each containing many entry points that perform different functions, the Sky card comes with many different microprograms that each perform one function. As a result, every time you want to perform a different function, you must load a different microprogram. This could prove to be a

problem for applications that are not dedicated to a single function. However, the card can be quickly reloaded in as little as 50 milliseconds if the routine is already in the host's RAM.

The data memory on the 321 maps into 128K of host memory area. The system comes with straps that let you start this 128K on any 64K boundary between addresses 40000H and B0000H. Although this approach is not a problem with dedicated signal-processing PCs without video displays, the presence of a video adapter limits the host to 512K of conventional memory.

The manual provided with the card is large and clear, with large chapter dividers



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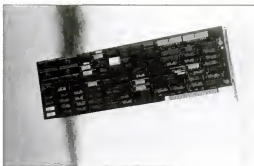
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## ■ THE SCIENTIFIC PC



*Most array processors come with a few microcode libraries, each performing many functions. But the Sky 321-PC/AT Model 3261 comes with many microprograms that each do one. To execute several functions, you hook up multiple 321s.*

and a good index. A diagnostic program is supplied with the card to verify proper installation. Although not menu driven, this program is thorough, clear, and easy to use. The documentation, which includes the Texas Instruments manual on the 32010 microprocessor, makes it clear that Sky expects the user to microprogram the 321. Sky includes a 32010 assembler and sells an optional C compiler for its AP, and its SKYDEB debugger contains all the usual features, such as breakpoint and single stepping.

The Sky 321 is a sound integer AP, especially designed for standalone, turnkey, and real-time applications.

### Systolic Systems PC100-32

### Systolic Systems PC100-64

Systolic Systems markets two floating-point array processors for the AT: the single-precision PC100-32 and the double-precision PC100-64. These two processors differ from the other APs tested in that they have no microprocessor or memory of their own, relying instead on the intelligence and memory of the host AT. This creates certain advantages and disadvantages.

The most obvious disadvantage is a serious degradation of speed. The PC100-32 required four times as long to complete the 1K complex FFT performance test as some of the other cards we reviewed. Another serious consequence is loss of concu-

rency: the host processor is not free to perform other tasks while the AP is performing its computations.

At the same time, this architecture has several important advantages. Since the PC100 uses the host's memory, it doesn't have to transfer data from the host's memory area into the AP's memory before performing the calculation, and then back again afterwards. Furthermore, there is no need to strap the card to any particular address to avoid conflicts with already installed memory. By using the host microprocessor, programmers of the PC100 do not require separate software development tools, nor must they go to the trouble of learning a new instruction set.

Interestingly, Systolic Systems markets a separate library, called *MathPak 87*, that provides the very same high-level lan-



#### FACT FILE

##### Systolic Systems PC100-32 Systolic Systems PC100-64

Systolic Systems Inc.  
1065 E. Brokaw Rd.  
San Jose, CA 95131  
(800) 621-0854, ext. 123  
(408) 286-0421

List Prices: PC100-32, \$4,240; PC100-64, \$4,485; *MathPak 87* library, \$495.

**In Short:** The single-precision PC100-32 and the double-precision PC100-64 have no microprocessor or memory of their own, using, instead, those of the AT. This results in slower speeds, but you don't have to worry about conflicts with the installed memory.

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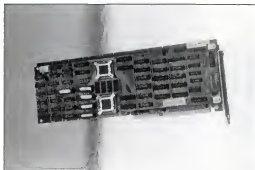
## ■ Systolic Systems includes a good diagnostic program with the PC100s that displays a table of pass/fail results.

guage routines but doesn't use the PC100. Although this package is not as fast as the PC100 package, it requires no special hardware other than an 8087 or 80287 math coprocessor. *MathPak 87* can come in handy for programmers developing code because it reduces the number of expensive PC100s necessary.

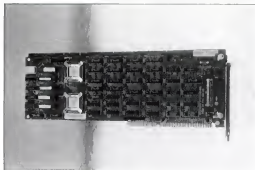
The documentation currently being shipped with the PC100 is woefully inadequate. The routines available to high-level languages are described clearly and completely, and useful examples are given, but the manual describes some earlier hardware implementation. Much of this section is inaccurate and misleading. By the time you read this, however, Systolic Systems should be shipping a new three-ring binder manual that addresses these criticisms. The PC100 package contained support for IBM Professional, Ryan-McFarland, and Microsoft FORTRAN; Microsoft, Lattice, and Computer Innovations C; and Microsoft Pascal.

Systolic Systems includes a good diagnostic program with their array processors. This program automatically and rapidly performs several different types of calculations, displaying a table of pass/fail results. The presence of all "pass" responses verifies proper functioning of the board. The PC100-32 worked properly on both 6-MHz ATs and the newer 8-MHz ATs; however, the PC100-64 reviewed had not been updated to work on 8-MHz ATs. An 8-MHz version of the PC100-64 should be available soon.

Although the PC100s could not match the operation of the other AP boards in PC Labs 1K FFT performance test, its perfor-



The single-precision PC100-32 from Systolic Systems, without its own microprocessor or memory, relies on the CPU and memory of the host AT. The host, therefore, cannot perform other tasks while the AP is doing computations.



The double-precision PC100-64 also relies on the host's CPU. As a result, programmers who use either of the Systolic Systems PC100 cards do not need separate software development tools, nor must they learn a new instruction set.



## EDITOR'S CHOICE

- Data Translation 7010
- Marincio APB-3016PC

If price is not a consideration, Editor's Choice goes to the Data Translation 7010. Although it supports only floating point, it was the fastest floating-point card tested—faster even than most integer cards. The card is easy to install and comes with an excellent diagnostic program.

For those of you who are on more limited budgets, the Marincio APB-3016PC will also give you excellent performance, and at a reasonable price. Not only is this the only array processor we tested that offers both 16-bit integer and floating-point capability, but it was also one of the fastest cards tested.

mance was much better than that of a simple numeric processor. For applications that do not require extreme performance, the unique architecture of the PC100s and the support of the MathPak 87 library give

them unique advantages over their competitors.

Stephen Randy Davis is a frequent contributor to PC Magazine.

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In all too many situations, 80287 accelerators and array processors just don't meet the needs of scientists, engineers, or researchers.

The Intel 8087 floating-point unit (FPU) is ancient as microchips go, and its younger sibling, the 80287, is not much better. Those interested in really heavy-duty processing will find these chips inadequate, even with an accelerator.

And while array processors are the undisputed musclemen when it comes to performing a small number of calculations on a massive amount of data, they are not suitable for applications that require a large number of calculations on a small amount of data. For instance, scientists are often unable to solve problems directly. Instead, they might start with an arbitrary guess at the solution, plug that number into the equation, and see whether it solves the problem. Then, depending on the answer, they would adjust the guess and plug it

back into the equation. In this way, a scientist gradually zeros in on the correct answer.

Newer processors with newer floating-point processors have been designed since Intel developed its 8087 and 80287 chips. They incorporate improvements in chip technology and they are good choices for solving such problems. National Semiconductor's 32032/32081 CPU/FPU can process floating-point numbers roughly three times faster than the 80286/80287 combination, and Motorola's 68020/68881 is roughly six times faster on straight numerical computations.

Plug-in accelerators using these chips—the non-Intel-compatible (NIC) cards—give PC users access to these alternative processors. Due to the differences between microprocessor families, very little integration of NIC hardware with host PC hardware is actually possible. The NICs are really quasi-independent "com-

puters on a card." Besides the CPU itself, these cards must have their own clock circuitry, memory, memory management, and floating-point processor. This self-sufficiency allows the plug-in cards to use wide 32-bit data paths, rapid processor clocks, and other such tricks to enhance performance. In some cases, the results are truly impressive. However, NIC cards do use the standard I/O channels—such as the keyboard, screen, and disk—of the host PC, which limits the data transfer rate to and from the NIC.

One warning: as with the array processors, you won't be able to use the non-Intel cards to improve the performance of off-the-shelf software. This is typically not a problem, since you'll probably need to write your own software for your specific number-crunching applications. However, it makes software support an important consideration. All of the NIC manufacturers provide the necessary assemblers and compilers for their cards.

Besides the speed benefits, programmers who dislike the assembly language of the Intel card might like the fact that using these cards gives them access to a different instruction set—perhaps one more to their liking. Assembler programmers, for instance, particularly tend to like the 68000 instruction set. Different CPUs also have different operating systems. Although UNIX look-alikes exist for the 80286, official System V UNIX ports exist for the 32000 family of microprocessors. These advantages make some NIC cards very attractive to companies and universities interested in creating the equivalent of a good-sized minicomputer out of an inexpensive PC.

To give you some idea of what is currently available, *PC Magazine* examined several NIC cards manufactured by Definicon Systems, Opus Systems, and Immos Corp.; these cards incorporate the National Semiconductor 32032, the Motorola 68020 and the Immos T414 microprocessors. Since each of these cards has a wide range of features and performs different functions, we were simply unable to perform a standard set of tests to compare the cards with each other. Nonetheless, while each of these cards uses a different approach, any one would be a welcome addition to my PC.

## DSI-780 Series

Definicon Systems named this card the DSI-780 to indicate that its number-crunching capability is similar to or exceeds that of that old workhorse of the engineering community, Digital Equipment's VAX 780. At first I was dubious of this claim, but comparisons of several benchmark tests substantiated it entirely. For instance, the popular DSI-780+/4 RAM measured 1.3 million Whetstones (the Whetstone is a standard benchmark test for speed). In contrast, a VAX 780 supermini measures 1 million Whetstones, and the top-of-the-line VAX 8600 measured 2 million Whetstones. It was only a few years ago that an entire department considered itself lucky to have access to just one VAX 780; now you can have one in your PC.

The DSI-780 comes in quite a number of models, all of which operate the same way, differing only in speed of performance. The smallest, the DSI-020, contains a 12.5-MHz 68020/68881 with 1 megabyte of RAM and costs \$995. There are a number of models, increasing in clock speed and memory up to Definicon's most popular model, the DSI-780+/4, which comes with a 20-MHz 68020/68881 with 4 megabytes of RAM and goes for \$3,595. You can also get larger models



*The DSI-780+/4 comes with a 20-MHz 68020/68881 with 4 megabytes of RAM. The card is unique in that even though it sports an AT-style double connector, you also can install it in your PC.*

that contain up to 16 megabytes of RAM. However, the price of these models increases disproportionately and changes frequently because of the need to use costly 1-megabit chips. Definicon made the DSI-780+/4 available for review.

Even though these cards sport an AT-style double connector, you can also install them in a PC (if nothing gets in the way of the second connector).

The DSI-780+ does not provide its own operating system. DSI executable programs are carried in DOS directories and look like any other file except for the characteristic .E20 extension. You execute these files on the card via the LOAD program. For example, a typical DSI command might be "LOAD FORTRAN EXAMPLE". The LOAD.EXE program first uploads a kernel executive into the DSI card and starts the card running. LOAD then finds the DSI executable file FORTRAN.E20 and passes it to the now running card followed by any arguments on the command line (in this example, "EXAMPLE"). The kernel passes control to the fully loaded DSI program. LOAD stays active, waiting for any I/O requests from the kernel. Once the FORTRAN program completes by executing the TERMINATE function call, the DSI card stops and LOAD returns to the user with a normal DOS prompt. Although it sounds complicated, the entire process takes no longer than running any other .EXE file. In fact, since the DSI card is so much faster, it usually goes by quicker.

The DSI-780+ card comes with an extensive manual that includes instructions for all of the possible options of all of the

cards Definicon sells as well as descriptions for each of the software options ordered. Standard software includes the loader, a linker, a nonmacro assembler, and a tiny BASIC. An included diagnostic program provides a complete memory test that verifies proper functioning of the card. The options, which sell for \$400 each, in-

## ■ The DSI-780's number-crunching capability is similar to that of the VAX 780.

clude a debugger as well as compilers for FORTRAN, Pascal, and C. The DSI debugger and at least one of the languages are a must with any DSI purchase.

To use the software, I copied the contents of each floppy into a separate subdirectory, which worked fine. The DSI software seemed to mesh very well with DOS. Definicon advises that under Concurrent DOS (an MS-DOS-compatible multitasking exec from Digital Research), the host PC can be used for other tasks while the DSI card is busy.

Definicon's DSI-780+ is an impressive package. The software seems well thought out and well executed. The hardware is impressive. All of this for a paltry few thousand dollars. If you want real roll-your-own power, no need to wait for the 386s. Here's the card for you.



## FACT FILE

### DSI-780 series

Definicon Systems Inc.  
31324 Via Colinas, #108/9  
Westlake Village, CA 91362  
(818) 889-1646

**List Prices:** DSI-020, \$1,094; DSI-750/1, \$1,495; DSI-780/1, \$1,995; DSI-780/2, \$2,495; DSI-780/4, \$3,295; DSI-780+/1, \$2,295; DSI-780+/2, \$2,795; DSI-780+/4, \$3,595; DSI-780+/8, \$7,995; DSI-780+/16, \$13,996. FORTRAN compiler, \$528; Pascal compiler, \$448; C compiler, \$398; Silicon Valley Basic Interpreter software, \$248; Graphics package, \$188.

**In Short:** A series of plug-in accelerator cards that use the Motorola 68020/68881 to give the PC number-crunching capability similar to or exceeding that of Digital Equipment Corp.'s VAX 780 supermini.

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✓ denotes IBM-AT compatibility.  
 \* denotes IBM-PCjr compatibility.  
 CP—copy protected, NCP—not copy-protected

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 Version numbers in our ads are current at press time.

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* Pizazz 1.0	35.
<b>Ashton-Tate ... NCP</b>	
* dBase III Plus 1.1	call
* Framework II 1.1	call
* Sign-Master 5.1 (CP)	149.
* Diagram-Master 5.01 (CP)	199.
* Chart-Master 6.2 (CP)	229.
* Map-Master 1.0 (CP)	239.
* MultiMata 3.31	call
* MultiMata Advantage 3.6	call
<b>Best Programs ... NCP</b>	
* PC/Tax Cut (1987 vers. for 1986 taxes)	49.
<b>Bible Research ... NCP</b>	
* THE WORD 3.1 (KJV Bible)	159.
* THE WORD 3.1 (NIV Bible)	159.
<b>Borland International ... NCP</b>	
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* Turbo Database Toolbox 1.2	41.
* Turbo Graphix Toolbox 1.0	41.
* Turbo Editor Toolbox 1.0	41.
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* Eureka 1.0	59.
* Turbo BASIC 1.0	59.
* Word Wizard 1.0	41.
* Turbo Pascal 3.0 w/BCD & 8087 support	59.
* Turbo Pascal w/Turbo Tutor	75.
* Turbo Prolog 1.1	59.
* Turbo Prolog Toolbox 1.0	59.
* Turbo Jumbo Pack	169.
* Sidekick 1.5	51.
* Traveling Sidekick 1.0	43.
* Traveling Sidekick w/Sidekick	73.
* Reflex 1.1	87.
* Reflex Workshop 1.0	41.
* Superkey 1.1	59.
<b>BPI Accounting ... CP</b>	
* General Accounting C.14	179.
<b>Breakthrough ... NCP</b>	
* Timeline 2.0	239.
* Timeline Graphics 1.0	105.
<b>Broderbund ... CP</b>	
* Print Shop	35.
* Print Shop Companion	33.
* Graphics Library 1	22.
* Graphics Library 2	22.
<b>Chipsoft ... NCP</b>	
* TurboTax 4.0 (1987 vers. for 1986 taxes) special	
<b>Computer Associates ... NCP</b>	
* Spreadsheet Auditor 3.0 (check your work)	89.

## PC Connection Software Special

through April 30, 1987

### CHIPSOFT ... NCP

#### \* TurboTax 4.0

Benjamin Franklin, a very intelligent man, once said that the only two sure things in life were death and taxes. Well, there's not a whole lot we can do about the first part, but TurboTax can make your April 15th a little easier.

- Calculates 30 different forms and schedules, as well as 4 supplementary worksheets
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For the IBM PC, XT, or AT ... \$45.

* SuperCalc 4.1.0	309.
<b>Crosstalk Communications ... NCP</b>	
* Crosstalk XVI 3.61	95.
* Remote 1.3	95.
<b>Dac Software ... NCP</b>	
* Dac Easy Port	19.
* Dac Easy Mate	26.
* Dac Easy Base	32.
* Dac Easy Payroll	32.
* Dac Easy Accounting	45.
<b>Executive Systems ... NCP</b>	
* XTREE 2.0	34.
* Hot 3.0 (DOS utility)	41.
<b>5th Generation ... NCP</b>	
* Fastback 5.14	89.
<b>Generic Software ... NCP</b>	
* Generic CADD 2.0	69.
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* Auto Dimensioning	35.
* Drafting Enhancements	35.
<b>Hervad Associates ... NCP</b>	
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<b>Infocom ... NCP</b>	
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* Volkswriter Deluxe Plus 1.0	69.
* Words & Figures 1.01	129.
* Volkswriter 3.1.0	147.
<b>Micro Education (MECA) ... CP</b>	
* Managing Your Money 3.0	115.
* Managing the Market 1.0	85.
<b>Micropro ... NCP</b>	
* WordStar Professional Release 4.0	259.

* WordStar 2000 Plus Release 2	\$285.
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* R-base System V 1.1	359.
* R-base Graphics 1.0	159.
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* Chart 2.02	189.
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* Project 3.0	239.
<b>LANGUAGES</b>	
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* FORTRAN Compiler 4.0	289.
* C Compiler 4.0	279.
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* VP-Info 1.0	57.
* VP-Expert 1.0	57.
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* SmartNotes 1.4	49.
<b>Peter Norton ... NCP</b>	
* Norton Commander 1.0	39.
* Norton Utilities 3.1	57.
<b>Quarterdeck ... NCP</b>	
* DESQView 1.3	85.
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* Webster's New World Speller 1.3	39.
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* Clip Art Volume 3 (for Newsroom)	19.
* Newsroom+Pro (NCP)	79.
<b>Symantec ... NCP</b>	
* Q & A 2.0	219.
<b>True BASIC, Inc. ... NCP</b>	
* True BASIC 2.0	109.
* True BASIC Libraries	each \$32.
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# om RAM riddles.

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• Professor DOS ...	33.
• Tutorial Set (both items above) ...	49.
• Typing Instructor II ...	26.
• Training for Lotus 1-2-3 (for vers. 1A & 2) ...	37.
Microsoft ... NCP	
• Learning DOS (for any version) ...	33.
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• Typing Tutor III 1.5 ...	33.

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• Computer SAT ...	35.
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Leather Goddesses of Phobos	
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## PC Connection Hardware Special

through April 30, 1987

### HAYES MICROCOMPUTER PRODUCTS

#### Smartmodem 1200 & 2400

Another famous person once said that no men is an island. Alternately, no computer stands alone. A modem is its link to the rest of the computing fraternity, and Hayes modems have been around since the advent of personal computers.

- Include all the standard modem features: auto-answer/auto-dial/auto-redial, speaker, input and output phone jacks, works with both touchtone or rotary phones
- Smartmodem 1200 is compatible with Bell 103A and 212A standards. Smartmodem 2400 is compatible with those plus the CCITT V.22bis standard. Both Smartmodems adhere to the Hayes AT command set
- Both require software and cable, sold separately

For the IBM-PC, XT, & AT

Smartmodem 1200	\$369
Smartmodem 2400	569
Smartcom II software	89
Computer-to-Smartmodem cable (specify serial port size) ...	15.

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• Datasaver 400 Watt (backup power unit) ... 499.

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• Keyboard Extension Cable (3 to 9 feet) ... 27.

• Extension Cables for IBM Mono Display ... 33.

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• NEW FX-286e (136 col., 200 cps) ... 579.

• LX-86 printer (80 col., 120 cps) ... 225.

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Toshiba T1100 PLUS Laptop Computer	call	
Toshiba T3100 Laptop Computer	call	
<b>Teag Labs ... 1 year</b>		
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70 Mega (formatted capacity) Int. Hard Drive for IBM AT (w/Wren Manager II software, 28 ms)	997
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10 Meg cartridge	57
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PC, XT 360k Drive (5 1/4" half-height)	109
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## ■ THE SCIENTIFIC PC

### DSI-32 Series

Definicon tries not to play favorites, offering cards driven by different microprocessor families. The DSI-32 is powered by National Semiconductor's 32032 microprocessor with a 32081 floating-point processor. While their different processors give them different operating characteristics, the DSI-780 series and the DSI-32 series are similar in almost every other respect. The manual, the software, the diagnostics, and the principles of operation are all virtually identical to the DSI-780 package; the optional compilers are from different companies, but support the same language. Perhaps most importantly, like the DSI-780+, the card worked fine the first time. This review discusses only the

differences between these two series.

The DSI-32 is available in models ranging from the 1-megabyte DSI-32/10 at \$1,495 to the 4-megabyte DSI-32E/4 at \$2,895—both driven at 10 MHz. While the DSI-32 is not quite the ferocious number crunching demon that the DSI-780+ is, it's certainly no slouch. While it is true that the 32032 processor cannot keep up with the 68020 in straight numerical operations, it does support virtual memory—something completely lacking in the DSI-020. Unfortunately, the disk accesses required by a virtual system would be very much slowed by the narrow PC bus, so this might not be such an advantage. While the DSI-780+/4 measures 1.3 million Whetstones, the DSI-32 measured only .3 million Whetstones.

Both the DSI-780 and the DSI-32 series products have their uses. If you prefer the 32032 instruction set or architecture, there is nothing about the DSI-32 package to stop you from having one for your PC. If all you want is pure numeric capability, maybe Definicon's 68020-based offerings would be more to your liking.

### Opus Systems 32.32 and 32.16 Cards

The Opus System 32.32 accelerator card is not at all like any other card tested in this review. While installing one of the DSI cards is similar to putting a VAX at the disposal of your PC, installing an Opus 32 card is more akin to actually subordinating your PC to a UNIX machine. The Opus 32 system replaces PC-DOS with a full implementation of AT&T's UNIX System V,



## FACT FILE

#### Opus Systems 32.32 and 32.16 cards (part of Opus 532 Personal Mainframe package)

Opus Systems  
20863 Stevens Creek, Bldg. 4  
Cupertino, CA 95014  
(408) 446-2110

**List Price:** Opus 532 Personal Mainframe including the 32.16 accelerator card, UNIX System V license, diskettes, manual, 2 Mbytes of memory, and National Semiconductor's 32016 processor, \$2,990; Opus 532 Personal Mainframe including the 32.32 accelerator card, UNIX System V license, diskettes, manual, 4 Mbytes of memory, and National Semiconductor's 32032 processor, \$4,550.

**In Short:** Unlike the other cards reviewed in this series, the Opus system replaced PC-DOS with a full implementation of AT&T's UNIX System V, Version 3, operating system, which gives you access to the wide range of technical and engineering software written for UNIX. The Opus 32.32 card comes equipped with a National Semiconductor 32032 CPU, 32081 FPU, and a 32082 memory management unit.

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## FACT FILE

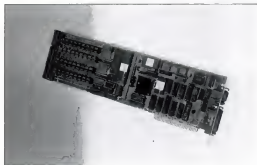
#### DSI-32 series

Definicon Systems Inc.  
31324 Via Colinas, #108/9  
Westlake Village, CA 91362  
(818) 889-1646

**List Prices:** DSI-32E2, \$2,295; DSI-32E4, \$2,895; FORTRAN, Pascal, and C compilers, \$400 each (FORTRAN compiler requires FORTRAN run-time library license, \$175); graphics package, \$165.

**In Short:** Operationally, this series of plug-in accelerator cards is almost identical to Definicon's DSI-780 series, but it uses National Semiconductor's 32032 microprocessor with a 32081 floating-point processor. While these cards are slower than the DSI-780 series, they offer virtual memory, which the 780 series lacks.

CIRCLE 655 ON READER SERVICE CARD



*The DSI-32 is powered by National Semiconductor's 32032 micro with a 32081 floating-point processor. Though it is not quite the number-crunching demon that the DSI-780+ is, it does support virtual memory.*

Version 3. Hence the Opus 32 gives PC users previously unattainable access to the large body of engineering and other technical software that has been written for UNIX since the operating system's birth at Bell Labs.

The Opus 32.32 comes with either an 8- or a 10-MHz National Semiconductor 32032 CPU with a 32081 floating-point unit and a 32082 memory management unit. The base card comes with 1 megabyte of RAM, but you can add optional 1- or 3-megabyte RAM cards. A slightly less expensive 32.16 card uses the compatible 32016 CPU.

The Opus 32 system comes with a good manual. The hardware installation section is clearly understandable, with large pictures of each DIP switch to be set. Installing the UNIX software was somewhat more complicated, but it, too, was clearly documented. Standard software includes a full port of AT&T's UNIX System V (Release 2.0, Version 2)—42 floppies' worth. Of these, you'll have to install about 10 floppy disks to operate the system. The re-

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CIRCLE 317 ON READER SERVICE CARD

## ■ THE SCIENTIFIC PC



*For the most part, installing the Opus 32 system transforms your PC into a 32032-based UNIX machine. But since the PC performs I/O for the Opus 32, you can still use RAM-resident programs you installed before entering UNIX.*

maining disks include a C compiler, a RATFOR compiler, a full set of games, and a host of other utilities.

Opus Systems' UNIX requires a minimum of 5 megabytes of disk space to operate, but it really works more comfortably at the 10-megabyte level. UNIX can occupy either its own disk partition or a single, very large file as its virtual disk, which means that it isn't necessary for you to partition your hard disk.

Once installed, you can conveniently enter UNIX from DOS at any time via the command "UNIX". While in UNIX, you of course cannot access DOS commands. The host PC becomes completely occupied in performing I/O for the Opus 32 card. For the most part, the PC is totally transformed into a 32032-based UNIX machine. Except for one fluke: since the PC performs keyboard I/O for the Opus 32, you'll still be able to use any RAM-resident programs that you installed in memory before entering UNIX. It was quite a curious feeling to enter *SideKick* from UNIX! While in UNIX, you can shell to DOS for occasional DOS commands or use a few DOS commands that have been added to Opus's UNIX. UNIX can be brought down at any time by entering the command "DOS".

Nowhere is there any mention made of exactly how many users Opus Systems' UNIX can adequately support, but the *Opus Systems Newsletter* mentions attaching 24 users to a single AT.

While not strictly a number cruncher, the Opus 32 can hold its own against accelerated ATs and the like. If you need UNIX capability, the Opus 32 just might be the answer.

## Imnos D700 Card and T414 CPU

The PC-based D700 card from Imnos Corp. is really more of an evaluation product than a performance card itself. The D700 card, which contains a single T414 CPU, also known as a transputer, basically enables you to see just how the transputer works. The 15-MHz T414 on the D700 runs at an average of 7.5 million instructions per second (MIPS). Using Imnos-provided optimized software, this combination can perform a single-precision floating-point add or multiply in roughly 16.8 milliseconds.

Transputers are also available in speeds up to 20 MHz or 10 MIPS. Besides the CPU, the card contains 2 megabytes of RAM. The communications lines of the T414 are brought out to connectors that allow the card to be attached to a separate chassis containing further transputers.

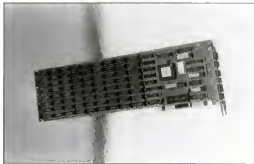
Although the T414 is a 32-bit microprocessor in its own right, what really sets the transputer apart is its ability to work

well with other transputers in large networks of processors. The transputer chip has four serial lines that allow the chip to be connected directly to four other transputers. The chip has the ability to communicate information with the other processors at the same time that it is working on a problem. This design adapts the chip well to multiprocessor applications. For instance, when presented with multiple problems, the transputer begins to work on the first problem and passes the remainder off to its neighbors. They pass the solutions back to the T414 transputer when they are finished. This efficient "divide and conquer" approach to computing gives networks of transputers the attractive potential for very large throughput.

Imnos provides its own Occam programming language, which was specially designed to allow you to take full advantage of the transputer's parallel processing capabilities. To accomplish this, the Occam programming language includes some rather interesting additions to typical programming primitives, such as special constructs to the serial lines that can be accessed even while other operations are going on. Parallel operations are controlled via the PAR and ALT commands. PAR (parallel) and ALT (alternate) have the following format:

PAR	ALT
case 1:	case 1:
case 2:	case 2:
.	.
.	.

PAR does not continue with the next instruction until each of the cases has com-



*The D700 card lets you see how the T414 CPU, also called a transputer, works. Although the T414 is a 32-bit microprocessor, what sets it apart is its ability to work with other transputers in large networks of processors.*

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—Jim Seymour, syndicated columnist, March 1988.

"TurboTax takes the prize for most firms' our favorites for this review were TurboTax —InfoWorld, March 1988.

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## ■ THE SCIENTIFIC PC



### FACT FILE

#### Inmos D700 card and T414 CPU

(part of D701 Transputer Development system)  
Inmos Corp.  
P.O. Box 16000  
Colorado Springs, CO 80935-6000  
(800) 348-0664

**List Prices:** D701 Transputer Development System package (including B004 accelerator card and D700 software), \$5,500; B004 accelerator card, \$3,500.

**In Short:** A package that enables you to use and test the Inmos T414 transputer. The transputer, with its Occam programming language, can allow you to perform parallel processing of data, giving you the potential for large throughput.

CIRCLE 663 ON READER SERVICE CARD

pleted. ALT continues on when any of the specified case statements complete. Occam automatically passes the various case statements to other processors to allow true parallel operation.

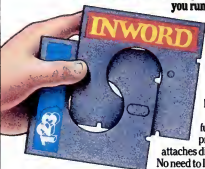
The D700 manual comes in a small three-ring binder that is similar in size to the IBM manuals but just a bit too long to fit comfortably on the same shelf with them. Inmos Corp.'s documentation is very good at giving you an overall view of the transputer system. Separate chapters in the manual were devoted to the five floppy disks of software, including installation instructions and a description of the Occam programming language compiler. No hardware installation instructions were included in the manual, but their absence might not be so bad since the board had no strapping options. Unfortunately, the software provided requires a full 640K in the host. 512K just did not make it.

The Inmos T414 processor is a very interesting and significant development. Things will get even more interesting in 1987 with the addition of a floating-point processor to the T414 transputer. As more companies begin to adapt this parallel processor to a variety of different applications, this CPU should have a great effect on the computer world.

*Stephen Randy Davis is a frequent contributor to PC Magazine.*

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# REMOTE



*Seen only in terms of sales, WordPerfect may be the single most successful word processing program on the market. We discuss why all those users can't be wrong—and give you two articles that show you ways to enhance your productive use of the program.*

# WORDPERFECT MADE EASY

Five years ago, the choice was simple. If you wanted a word processor, there was *WordStar*, which was pretty good and still is—and *EasyWriter* (remember *EasyWriter*?) and a handful of others that weren't. So you bought *WordStar*.

Now, there are some 75 word processors on the market. While choices abound, buyers seem to cluster around only a handful of these products. Five word processors own, by best estimate, about three-quarters of the market.

The killer program is *WordPerfect* from WordPerfect Corp. (formerly Satellite Software International), which is estimated to hold 30 percent of the market. *Microsoft Word* and Ashton-Tate's fading *MultiMate* each have about half that, and MicroPro's *WordStar* and IBM's *DisplayWrite* a bit less. All of them list in the \$450 to \$500 range and can be had on the street for around \$250. (Others with a claim to the top five or six are the *PFS: Write/Professional Write/First Choice* trilogy and *WordStar 2000*—but if you believed everything the vendors said, 100 percent of the market would amount to 150 percent.)

*WordPerfect*'s status stems not so much from any single dazzling feature, as does *Word*'s with its mastery of laser printers or *XyWrite III*'s with its blazing speed. Rather, *WordPerfect* does everything well and avoids some of the problems hampering the competition.

*WordPerfect* never was copy protected and never will be, unlike some Microsoft and MicroPro offerings that tried, then abandoned copy protection. It doesn't suffer as much as *Word* from running on a 4.77-MHz PC, and it's nowhere near as tough to learn. It doesn't suffer from *MultiMate*'s page-oriented link to the onemighty *Wangwriter* that was *MultiMate*'s biggest asset and now may be its downfall. Nor has *WordPerfect* failed to keep up with modern times, unlike *WordStar*, which took nearly 4 years to get from Version 3.3 to 4.0 and still lacks automatic paragraph reformatting.

*WordPerfect* resembles a Swiss Army knife, with a spelling checker, thesaurus, macro language, mail merge, on-screen math, sort facility, and on-disk tutorial. The only extra is a \$129 *WordPerfect Library* if you want to integrate the rest of the *WordPerfect* line (a pair of \$195 databases



## ■ WORDPERFECT

and spreadsheets) and toss in a bunch of *SideKick*-like utilities. Nice little features abound: for instance, line numbers in the left margin next to each line, or the ability to print text side by side, like newspaper columns or for a TV script. Lawyers have just about made *WordPerfect* the official product of the American Bar Association for its ease in building a table of authorities (references).

File handling is as good as it gets—you can look at disk directories, copy or delete files, search a directory for files containing a specific phrase (à la *The Norton Utilities* Text Search), and maintain a document summary of who created and typed a file and what the file is about.

The *WordPerfect* manual is above average, and if you're really stumped, *WordPerfect* maintains a free, toll-free help line. No other big-time program—word processor, database, or spreadsheet—offers that type of service.

*WordPerfect* presents the user with a simple, uncomplicated typing screen. No borders and boxes pretending to be the sides of a sheet of paper, no colorful header, no icons perched in a row awaiting the click of a mouse button. It's blissfully blank except for a single line of information at the bottom, which leaves 24 of the 25 lines free for you.

For people who want to learn (or learn more about) *WordPerfect*, *PC Magazine* presents a pair of productivity-enhancing articles on *WordPerfect*. The first one looks at the plethora of books, disks, cassettes, and other learning aids on the market to help newcomers get up to speed with the program. If you already know *WordPerfect*, chances are you'll be asked how to learn *WordPerfect*, and recommending a good book may be less time-consuming than getting roped into conducting a 2-hour training session.

The other article is a hands-on tutorial on creating and using *WordPerfect* macros. Even if you're familiar with creating and using *WordPerfect* macros, several are worth adopting. For instance, if you've ever been annoyed by all the laser printers that dump their output with the last page on top and the first page on the bottom, we've included a simple macro that forces an HP Laserjet to give up its printout in the correct order.—Bill Howard

PRODUCTIVITY DANIEL J. ROSENBAUM

*There's a stack of books, tapes, and disk tutorials designed to get you up to speed with WordPerfect. We sort out the best from the rest.*

# SEVENTEEN WAYS TO LEARN WORDPERFECT

**W**ordPerfect is not especially difficult to coax into performing elementary tasks, but accessing all of its power can get complicated. Although the manual is clearly written, the help screens are well designed, and an on-line tutorial is included in the latest release (Version 4.2), many new users seek additional help in getting up to speed with the program.

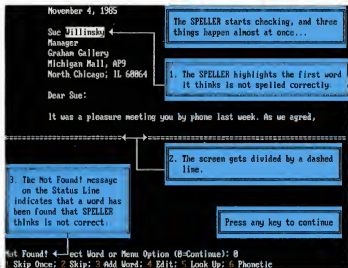
Manufacturers of training materials have responded to this need with a slew of books, audiovisual courses, disk-based tutorials, and other aids designed to smooth the *WordPerfect* learning curve. The number, if not the quality, of *WordPerfect* aids is impressive. The sampling of products reviewed here includes nine books, one set of audiocassettes, two keyboard templates, one set of videocassettes, a set of laserdiscs with dedicated video terminal and EPROM cartridges, two disk-based tutorials, and one workbook. Prices range from \$10.75 to \$1,495.

The value of the products ranges just as widely. Some training aids do nothing more than duplicate or rearrange information contained in the *WordPerfect* manual, while others seem to confuse the issues

more than clarify them. Some, however, provide tips you won't find in the kit you get when you shell out \$450 for *WordPerfect* (for tips on learning *WordPerfect* macros, see "Eight Ways to Improve WordPerfect"). And other training companies use audio and video techniques, which they feel make learning easier.

No matter which type of training aid you choose, you should make sure the book, cassette, or videotape you buy matches the *WordPerfect* version you're using. The product has gone through several upgrades since its 1982 introduction, the most recent being the Version 4.2, which appeared in October 1986. The previous version, 4.1, is also in wide use; the differences between 4.1 and 4.2 are not significant. However, *WordPerfect* 4.1 contained many more features than 4.0. These 4.1/4.2 additions, which include a thesaurus, split-screen capability, block text functions, and on-screen column formatting, won't be covered in a book or course that deals with Version 4.0.

**GOING BY THE BOOK** Books are the largest category of *WordPerfect* training aids. Of the nine reviewed here, two, *Dy-*



The All-Hands-On WordPerfect Learning Disk from Retrieval Technology displays instruction windows on top of the user's copy of WordPerfect.

namics of WordPerfect by Trish McClelland (Dow Jones-Irwin) and WordPerfect for the IBM PC by Dinah M. Davis (Holt, Rinehart and Winston), are victims of the 4- to 8-month lead time required for books to reach the shelves. Both books are good efforts, but they cover only Versions 3.0 and 4.0. This is a particular shame in the case of the Davis book, since the material is well organized and the book is one of the most physically attractive of the bunch.

Of the others, three stand out. The WordPerfect Book by Leo J. Scanlon (Tab Books) deals with Version 4.1. It is clearly written and well organized. Scanlon ends each chapter with a question-and-answer section, as well as hints and warnings about what you just learned and a recap of key points. The book's design won't win any awards, but read carefully and you'll learn the program.

Another worthy product is Using WordPerfect, Revised Edition, by Walton Beacham and Deborah Beacham (Que Corp.). This book focuses on WordPerfect 4.0 and adds a chapter on 4.1. Although its screenshots aren't always clear or even necessary, it is an adequate guide to the program's functions and features.

For the WP power user, there's WordPerfect Tips and Tricks by Alan R. Neibauer (Sybex). This book is suited for people who learn things by poking at a keyboard. While all the other books try to teach in some kind of linear fashion, Neibauer talks about ways to use the program. The basics take up only about the first 50 of more than 400 pages. The rest of the book deals with real power applications; the last couple of chapters on advanced macros are full of examples that lift the book above the rest of the field. If you already know WordPerfect and want it to jump through hoops, check out this book.

Sybex's other WordPerfect book, Mastering WordPerfect, by Susan Baake Kelly, is hindered by poor design. The typeface is difficult to read, and each chapter starts with a diagram printed over a background that is supposed to look like marble. Although the diagram is a nice device in that it previews the functions and corresponding keys covered in the chapter, the background is too distracting. The organization and writing style are serviceable, though not inspired, but the book's design completely sabotages the author's efforts. Stay clear.

■ If you already know WordPerfect and want it to jump through hoops, check out WordPerfect Tips and Tricks by Alan R. Neibauer.

Advanced WordPerfect: Features and Techniques by Eric Alderman and Lawrence J. Magid (Osborne/McGraw-Hill) and Working with WordPerfect by Beverly B. and S. Scott Zimmerman (Scott, Foresman & Co.) are both quite serviceable and have frequent flashes of humor. The Zimmerman book goes a little overboard on the humor, though—its table of contents and section headings are so droll as to be almost useless.

Alderman and Magid keep their word-play subtle and within bounds; discussing WordPerfect's ability to convert documents to and from the obscure Navy DIF (Data Interchange Format) specification, they say, "If you are in the Navy, you probably already know everything you need to about this format; if you are not in the Navy, you probably still know everything you need to about this format."

Finally, WordPerfect Corp. itself publishes WordPerfect Lessons—A Classroom Workbook. This is simply a bound edition of the tutorials found in the WordPerfect manual. It's meant for classroom instruction, and the teacher's manual comes with a wall poster of the keyboard and five extra function key templates (plastic overlays that sit on top of the keyboard and relabel the keys to help you remember WordPerfect commands and keystroke combinations). If you have the manual, there's no reason to get this book, unless you really want the extra templates.

Do you need any of these books? Yes and no. As manuals go, WordPerfect's isn't bad. None of these books is a must-buy, though the Neibauer is a real keeper and goes far beyond what any of the others



## FACT FILE



**WordPerfect**  
WordPerfect Corp.  
288 W. Center St.  
Orem, UT 84057  
List Price: \$495  
Requires: 256K RAM,  
two disk drives, DOS 2.0  
or later.  
In Short: Not copy pro-

TECTED.

CIRCLE 645 ON READER SERVICE CARD

### BOOKS



**Mastering WordPerfect**  
By Susan Banke Kelly  
Sybex Inc.  
2344 Sixth St.  
Berkeley, CA 94710  
(800) 227-2346  
Copyright: 1986  
List Price: \$19.95  
In Short: Reasonably  
good content sabotaged by awful design.

CIRCLE 646 ON READER SERVICE CARD



**WordPerfect Tips and Tricks**  
By Alan R. Neibauer  
Sybex Inc.  
2344 Sixth St.  
Berkeley, CA 94710  
(800) 227-2346  
Copyright: 1986  
List Price: \$18.95

In Short: A treasury of shortcuts and hints. Best for the advanced user but valuable to all but the absolute beginner.

CIRCLE 647 ON READER SERVICE CARD



**Advanced WordPerfect: Features and Techniques**  
By Eric Alderman and Lawrence J. Magid  
Osborne/McGraw-Hill  
McGraw Hill Training Systems  
P.O. Box 641

Del Mar, CA 92014  
(800) 421-0833  
(800) 662-6222 (in Calif.)  
Copyright: 1986  
List Price: \$16.95

In Short: An advanced guide seasoned with subtle humor, clear writing, and solid examples.

CIRCLE 648 ON READER SERVICE CARD



**Working with WordPerfect**  
By Beverly B. and S. Scott Zimmerman  
Scott, Foresman & Co.  
1900 E. Lake Ave.  
Glenview, IL 60025  
(312) 729-3000  
Copyright: 1987

List Price: \$18.95

In Short: Heavy-handed humor undermines an otherwise adequate work. Its organization could be better.

CIRCLE 649 ON READER SERVICE CARD



**The WordPerfect Book**  
By Leo J. Skanton  
Tab Books Inc.  
Blue Ridge Summit, PA 17214  
(717) 794-2191  
Copyright: 1986  
List Price: \$16.95

In Short: One of the better WordPerfect books. Not pretty, but presents topics well and in an intelligent order. Chapters end with a solid recap.

CIRCLE 650 ON READER SERVICE CARD



**Using WordPerfect, Revised Edition**  
By Walton Beacham and Deborah Beacham  
Que Corp.  
7999 Knue Rd.  
Indianapolis, IN 46250  
(800) 428-5331  
Copyright: 1985

List Price: \$18.95

In Short: Not the best of the lot, but one of the most complete. Needs an update: it focuses too heavily on Version 4.0.

CIRCLE 651 ON READER SERVICE CARD



**WordPerfect for the IBM PC**  
By Dinah M. Davis  
Holt, Rinehart and Winston  
383 Madison Ave.  
New York, NY 10017  
(212) 750-1330  
Copyright: 1985

List Price: \$10.75

In Short: Outdated; it emphasizes Version 3.0, which is nearly prehistoric in WordPerfect terms. A pity, since the book is attractive and well organized.

CIRCLE 652 ON READER SERVICE CARD



**Dynamics of WordPerfect**  
By Trish McClelland  
Dow Jones-Irwin  
1818 Ridge Rd.  
Homewood, IL 60430  
(800) 841-8000 ext. 33  
Copyright: 1986  
List Price: \$19.95

In Short: Obsolete; deals mostly with Version 3.0. Poorly organized.

CIRCLE 653 ON READER SERVICE CARD

offer. Still, people learn in different ways, and if you feel shortchanged or overwhelmed by the manual, the extra \$15 or \$20 is a good investment if it makes you more comfortable with the \$495 price tag that WordPerfect brings.

**KEYBOARD TEMPLATES** Another type of training aid that can speed your progress along the learning curve without

breaking your budget is a third-party keyboard template. Two companies have attempted to improve on the template that is supplied with the program by adding extra features.

Systems Management Associates offers a heavy plastic sheet, called PC-Documate, that fits on your keyboard surrounding the keypads. Commands are printed on both sides and organized into groups by

function: all the printing commands are in one place, while all the editing and typing commands are somewhere else. Cursor control keys are on both sides.

Unfortunately, the SMA template labels only the shifted and unshifted positions of the function keys—leaving the Ctrl and Alt positions for the rest of the template. The irony of this organization is that WordPerfect itself groups all print,

**WordPerfect Lessons—A Classroom Workbook**  
WordPerfect Corp.  
288 W. Center St.  
Orem, UT 84057  
(801) 227-4070  
Copyright: 1986  
List Price: \$19.95

**In Short:** A bound edition of the training exercises included in the *WordPerfect* manual. For classroom use only.

CIRCLE 001 ON READER SERVICE CARD

## TEMPLATES

**PC-DocuMate**  
Systems Management Associates  
3325 Executive Dr.  
P.O. Box 20025  
Raleigh, NC 27619  
(800) 762-7874  
List Price: \$14.95

**In Short:** Redundant for hard disk users—all of its material and more is available through *WordPerfect's* Help facility.

CIRCLE 000 ON READER SERVICE CARD

**WordPerfect 4.1**  
Kleertex Keyboard Booklets  
Creative Computer Products  
6369 Nancy Ridge Dr.  
San Diego, CA 92121  
(800) 231-5413  
(800) 523-5441 (in Calif.)  
List Price: Booklet, \$19.95; template, \$14.95.

**In Short:** Somewhat helpful but hard-to-read plastic booklet meant to stick to the keyboard.

CIRCLE 000 ON READER SERVICE CARD

formatting, merge, and macro commands on the same keys, so the SMA template often winds up duplicating the *WordPerfect* template. PC-DocuMate retails for \$14.95 and is available for the IBM PC keyboard, the IBM Enhanced keyboard, the AT, the AT&T 6300 (though not the 6300 Plus), all Compaqs, all Key Tronics, and others.

*WordPerfect 4.1* Kleertex templates from Creative Computer Products take a

## DISK TUTORIALS



**AT&T Teach Yourself WordPerfect**  
American Training International Inc.  
12638 Beatrice St.  
Los Angeles, CA 90066  
(800) 421-4827  
(213) 823-1129 (in Calif.)

List Price: \$99.95

**In Short:** A mechanistic, superficial, and incomplete introduction to *WordPerfect*.

CIRCLE 000 ON READER SERVICE CARD



**All-Hands-On WordPerfect Learning Disk**  
Retrieval Technology  
(now Hands On Learning Corp.)  
3 Courthouse Ln.  
Chelmsford, MA 01824  
(617) 458-1130  
List Price: \$74.95

**In Short:** A thorough introduction to *WordPerfect*. Leads you through an actual copy of the program.

CIRCLE 007 ON READER SERVICE CARD

## WORKBOOKS



**Introduction to WordPerfect**  
Electronic Learning Facilitators Inc.  
7101 Wisconsin Ave.  
Bethesda, MD 20814  
(301) 986-4929  
List Price: \$16.95

**In Short:** A top-flight value, though anything but slick. The spiral-bound book includes a floppy disk but has no index and is sometimes obtuse.

CIRCLE 000 ON READER SERVICE CARD

slightly different tack. They duplicate the *WordPerfect* template, but allow users to flip them over and write on the other side, providing two uses for one product.

Kleertex also offers a 6-inch long lightweight plastic booklet that attaches to the keyboard with adhesive tape. The 16-page booklet is thumb-indexed and has a detailed table of contents on the inside front cover.

## VIDEOCASSETTE

**Perfect Teacher!**  
CMS/Data Corp.  
187 Office Plaza Dr.  
Tallahassee, FL 32301  
(904) 878-5155

List Price: VHS and Beta versions, \$495; U-Matic format, \$695.

**In Short:** Badly organized, badly presented, low production values. Includes instruction on running *WordPerfect* on both PCs and DEC minicomputers.

CIRCLE 000 ON READER SERVICE CARD

## VIDEODISK

**WordPerfect**  
Comsell Inc.  
500 Tech Pkwy.  
Atlanta, GA 30313  
(404) 872-2500

List Price: \$1,495 per course (not including equipment).

**In Short:** A topflight course, well presented and structured correctly. Price and equipment prohibit individual ownership, but corporations should consider this course.

CIRCLE 004 ON READER SERVICE CARD

## CASSETTES



**How to Use WordPerfect**  
FlipTrack Learning Systems  
999 Main St., #200  
Glen Ellyn, IL 60137  
(800) 222-3547  
(312) 790-1117 (in Ill.)  
List Price: \$89

**In Short:** A novel idea executed well. The course is logical, complete, helpful, and inexpensive.

CIRCLE 000 ON READER SERVICE CARD

If you'd rather look at a booklet than your screen, this one is fairly helpful; unlike the *WordPerfect*-supplied Quick Reference Card, it groups operations together by function. Unfortunately, its typeface is hard to read, and the way material is organized under each topic heading can be confusing. The booklet, available for Versions 4.0 or 4.1, has a suggested retail price of \$19.95.

## ■ LEARNING WORDPERFECT

Kleartex also makes a full-keyboard template that retails for \$14.95 and will fit the IBM PC, the AT&T 6300 (though not the Plus), the Key Tronic 5150, the Compaq line, and others. None is currently available for the IBM Enhanced keyboard.

If you have a hard disk, you don't need either of these templates: striking F3 will bring up a help screen. Typing the first letter of what you think you want to do (C for cursor control) will bring up a guide to everything *WordPerfect* will do that starts with that letter. Pressing a function key after hitting F3 will give complete help about that key. Floppy disk-based systems need a disk swap after hitting F3 to use the help utility, so the templates may save some work there.

**SON ET LUMIERE** At the other end of the spectrum in terms of price and complexity are audiovisual training materials such as the interactive videodisk-based corporate training center from Comsell. The courses cost between \$1,495 and \$2,000, and require a special terminal and an industrial laserdisk player.

Comsell's courses, *WordPerfect* included, will run on the Visage, IBM InfoWindows, or Sony VIEW system. Depending on the system, it will use either a keyboard, touch-screen, or light pen. It can also use Comsell's own Learning Center, whose terminals are converted coin-operated barroom video poker games.

Its odd hardware aside, the Comsell *WordPerfect* course is pleasant and effective. The actor is attractive, well spoken, and believable, the sound and video are sharp, and the lessons and drills are well planned. However, the quality of the on-screen text during quizzes and some expositions, though adequate for a 90-second video game, is too tedious for an 8-hour training course.

*Perfect Teacher!*, a workbook, a floppy disk, and a pair of videocassettes from CMS/Data Corp., starts off with an extended explanation of who owns what copyrights and what the authorities will do to you if they catch you doing something naughty. The tape goes downhill from there.

The material on *Perfect Teacher!* is presented in apparent reverse order. Merges and macros are covered even before tabs

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■ Kleartex's templates duplicate the *WordPerfect* template, but allow users to flip them over and write on the other side, providing two uses for one product.

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and margins, searches or replaces, defining blocks, or revealing codes. Production values are strictly those of local access cable TV; shots of the computer screen are difficult if not impossible to read; background noise and the overall sound level vary widely (but the former is always too high); the video lacks definition; and the actress is stilted and plainly reading off cue cards. CMS/Data should take some lessons from Comsell in building good courses.

CMS/Data also makes the mistake of using the same tape to train on both IBM PCs and Data General minicomputers (for which *WordPerfect* was originally designed). That forces CMS/Data to explain that when it's talking about Data General computers, it doesn't mean the Data General One portable, which is a PC. As a result, you are advised that the tape will refer to function keys, but not the Ctrl, Alt, or Shift positions so as not to confuse Data General users, who don't have those keys.

Less elaborate (and expensive) than the Comsell and CMS/Data training courses are a couple of interesting floppy disk-based tutorials.

American Training International (ATI) is the major vendor of interactive tutorials, but its *ATI Teach Yourself WordPerfect* tutorial fails to illustrate why. The ATI course is quick but dreadfully superficial; you will learn the basics but only the basics. It is not especially interesting or entertaining, and like all such tutorials it is restrictive. ATI says the purpose of the course is to get you up to speed as quickly

as possible; the lack of depth may or may not be an acceptable trade-off, depending on your priorities.

One complaint about content: the course tells you to start a search by pressing the Esc key, which in all other cases is used to repeat subsequent keystrokes. Every other manual or book advises to start a search by pressing the Search key again, a potentially less confusing or damaging procedure.

Another tutorial, *All-Hands-On WordPerfect Learning Disk* from Retrieval Technology (now Hands On Learning Corp.), is an improvement. It is slower than the ATI course, but it is more thorough, more entertaining, and more interesting. While ATI simulates the *WordPerfect* screen Retrieval actually uses your copy of *WordPerfect* to teach its lessons, displaying "Post-it"-type rectangles on-screen to give instructions or illustrate points.

A third tutorial is *Introduction to WordPerfect*, a 100-page comb-bound workbook produced by Electronic Learning Facilitators (ELF). The workbook is accompanied by a floppy disk containing nine documents used in the course of reading the book's eight units. The ELF workbook does not contain an index, is not organized very well, is at times unclear, and is far from slick. But at \$16.95 it's cheaper than most books, let alone other alternative media products.

**BEST BUY** Of all the training aids reviewed here, the best organized is the FlipTrack Learning systems cassette tape program, *How to Use WordPerfect*. Like other FlipTrack packages, this one puts the basic instructions on one side of the tape, with expanded or advanced instruction on the other. When you want more help or want to explore a topic in greater depth, reset your cassette player's tape counter to zero, turn over the tape (hence the name), and play that side. When you're finished, rewind the tape back to zero, turn the tape over, and proceed.

*How to Use WordPerfect* includes four tapes and a well-indexed reference guide. Topics are presented in a logical, helpful manner, sound quality is clear (though you'll want to leave your noise-reduction control on), and the announcer's voice is

# AN INVITATION FROM THE #1 DATABASE SOFTWARE.



**Rated #1 By DataPro.**

"Microrim's R:BASE System V far outshines its competition."

**—DataPro Reports**

Best Data Management Software of 1986.

**—PC Magazine**

"...A superset of dBASE III Plus functionality."

**—InfoWorld**

"...You've simply got to look at R:BASE System V.  
It's brilliant."

**—Jim Seymour  
PC Week**



# PLAY WITH YOUR DATA.

**W**hen we created R:BASE System V, the whole idea was to make the full power of a sophisticated relational database available to people who don't feel like programming. Thanks to your enthusiasm, it's been quite a success. With our Express System, R:BASE System V offers you a combination of speed, power, and flexibility that's literally not available with any other DBMS. And now, we're introducing a new presentation graphics package that gives you the opportunity to play with your numbers and ideas in graph form.

But first, let's take a look at R:BASE System V, the product which makes R:BASE Graphics a powerful tool for understanding.

**DATA MANAGEMENT  
RESULTS IN HOURS—  
NOT MONTHS.**

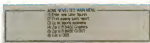
With R:BASE System V, no matter how sophisticated the application, you just follow a simple, fill-in-the-blanks format, and our Application EXPRESS writes all the code automatically.

As a result, even as a first-time user, you can build a powerful, automated application. With the features you'd expect in a custom program from a professional programmer.

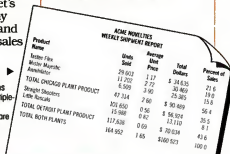
When you're done, you'll have automated the process

of understanding your data. And be able to use it to make better decisions. With other database products, building an application like that could take months. But for a fairly typical application, with R:BASE System V, it's a matter of hours. For example, let's take a look at a company called ACME Novelties and follow them through a sales analysis.

To update a report like this takes just a few keystrokes, even though it contains computed columns, subtotals, and multiple-table access. And this is just the beginning; with new R:BASE Graphics, there are literally thousands of ways to play with these numbers.



▲ With our Express System, it's easy to build an automated application without programming. From this point on, any of these functions can be performed by a simple menu pick.



**INTRODUCING  
R:BASE GRAPHICS.  
TURN RAW DATA INTO  
PURE UNDERSTANDING.**

Of the 100-plus graphics products on the market, this is the only one that works directly with R:BASE System V or R:BASE 5000/4000 data. And the only one that combines presentation-level graphics with powerful data reduction capabilities. With just a few keystrokes, R:BASE Graphics can sort through megabytes of data, retrieve just the data you're interested in, compare items any way you like, and put



them into presentation-quality chart or graph form.

You won't even have to interrupt your train of thought. With RBASE Graphics, you keep right on using the same familiar interface. You enjoy a totally integrated solution that turns raw data into pure understanding. And now you can express it graphically.

Let's take a look at the example here and see how the process works. The first screen you see is raw, un-

sorted R:BASE data. (This is the same data R:BASE System V would use to give you the ACME Novelties weekly sales report.) All you do is tell R:BASE Graphics what you want, and how you want it. It goes into the database, performs the sorting requests, and creates a graphable subset of the database. If you want a column graph that compares total product sales by month, all it takes is a few keystrokes, and you've got it.

Of course, this is only one example; with R:BASE Graphics, using a database to reach new levels of understanding is limited only by the imagination.

R:BASE Graphics gives you eight standard chart or

graph formats, plus seven text fonts, 16 colors, and up to 32 windows of split-screen displays. R:BASE System V SuperMath functions have also been included for precise data handling. In all, there are over 40 mathematical, trigonometric, logical and financial operations. Of course, R:BASE Graphics supports most popular video control cards, plotters, and printers.

As you've already seen, by using R:BASE Graphics, ACME Novelties graphically identified their problem area: The Eastern Region. Now we'd like to show you another product that lets ACME review their data in a completely different way. R:BASE CLOUT.<sup>®</sup>

## R:BASE CLOUT THE DATA RETRIEVAL SOFTWARE THAT SPEAKS YOUR LANGUAGE.

### ENGLISH.

This artificial intelligence, natural language query software gives you another option. You just type your requests in plain English. CLOUT figures out exactly how to get the answers by translating common questions into computer commands.

CLOUT's natural language dictionary contains 300 commonly used words, and you can add 500 more (with definitions) per database. By adding unique definitions, you can customize CLOUT to your specific needs. Now let's go back to our example for a minute:

From R:BASE Graphics, we saw the problem at ACME Novelties was weak sales in the Eastern Region. Now the question is—who's responsible? Suppose we had taught CLOUT that the name for distributors was "bigshots."

Current Status of Region

REGIONAL SALES IN THE EASTERN REGION TO 7 MONTHS 1978 PLAY MOD

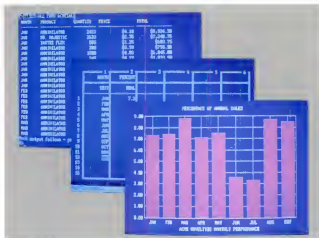
Product: Novelty 100 100 100 100 100 100 100

DIST	NAME	SALES 65	SALES 66
1000000	NEW YORK NY	120,000.00	110,000.00
1000000	NEWARK NJ	100,000.00	90,000.00
1000000	PHILADELPHIA PA	150,000.00	140,000.00
1000000	PITTSBURGH PA	130,000.00	120,000.00
1000000	RICHMOND VA	110,000.00	100,000.00
1000000	WASHINGTON DC	140,000.00	130,000.00
1000000	WILMINGTON DE	120,000.00	110,000.00

END REPORT ON 7/17. For more info, call 1-800-451-1234.

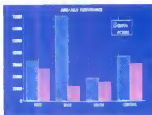
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## ■ WORDPERFECT

### ■ THE ATI course

is quick but dreadfully superficial; you will learn the basics of *WordPerfect* but only the basics.

Two complaints and an observation: you are steered to the manual for instructions on how to set up your machine. As long as you've got the manual's instructions there, why not just run through the manual's whole tutorial? Also, tape counters are not always standard equipment on portable cassette players. The alternative—the numbered tape guides below the cassette's clear window—are not nearly exact enough.

Lastly, I could not shake the feeling, listening to these cassettes, that I was back in my junior high language lab, learning Spanish with those blasted ALM tapes. (HOLA, Isabel! ¿Como estas? Estoy bien, gracias. ¿Y tu? Bien, gracias. . .)

There is no shortage of ways to learn *WordPerfect*. If none of these suit you, you have three choices: get your typewriter back out of the closet, muddle through and write your own book/tape/disk based on how you did it, or go back to *WordStar*. No, there is a fourth choice—one I recall from a bicycle repair book I own.

"The last tool you'll need," the book says, "is a friend to help you. If you do not have a friend, we advise you find one at your first opportunity." *WordPerfect's* enormous popularity should make it easy to find a user group, colleague, or friend who can help you over the rough spots on the way to mastering the program.

Daniel J. Rosenbaum is executive editor of *Wiretap*, a monthly newsletter that tracks developments in the computer and communications industries. He is also coauthor of a forthcoming book, *WordPerfect Tips, Tricks and Traps*.

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*In this step-by-step tutorial you can learn the basics of WordPerfect macros. The eight macros included here can save precious time and repetitive keystroking for some of the more mundane chores of your working day.*

# EIGHT WAYS TO IMPROVE WORDPERFECT

One of the many features that make WordPerfect such a desirable program is the built-in macro function. A macro is a series of recorded keystrokes that can be called into a document easily and quickly.

On the simplest level macros can spare you the worst sort of typing tedium and, at their most sophisticated, they work major miracles in the twinkling of an eye. For instance:

- By holding the Alt key and tapping the letter N on systems I've set up for clients in the New York City area, "New York, New York 100" appears on-screen, with the cursor positioned to fill in the last two characters of the New York City ZIP code. That Alt-N (for New York) macro, often used on the last line of the inside address on letters to be mailed locally, saves 21 keystrokes each time it's used, and I'll bet it's used hundreds of times each day.

- For a client in the retail business I took advantage of WordPerfect's built-in math capability and wrote an invoice-calculating macro (Alt-C) that multiplies across (quantity times unit price equals extended price), adds down for a subtotal,

calculates and displays the sales tax two lines below the subtotal, then, two lines farther down in the total column, adds the subtotal and tax and double-underlines the result. The macro ends by sending the finished invoice to a laser printer.

- Most laser printers stack their output backwards. The final page is on top, the first page on the bottom. A two-keystroke macro reverses the output of a laser printer, putting page 1 at the top of the stack.

- Another macro sets a letter header, putting the addressee's name, the date, and the page number at the top of all pages after the first.

Macros such as "New York, New York 100" can be utterly simple to write, and the only limitations to staggeringly complex macros are disk space and imagination; absolutely anything WordPerfect can do can be included in a macro.

Despite the usefulness of macros and the ease with which they can be written, it continues to surprise me that so few WordPerfect users have learned about them. "No, I haven't gotten to macros yet" is a somewhat sheepish, often repeated statement.

Perhaps WordPerfect users believe "writing macros" sounds too much like "computer programming." That is definitely not true—writing a macro is nothing more than recording keystrokes for quick and easy playback. And it's far easier than writing 1-2-3 macros.

What's a good candidate for being incorporated as a macro? Anything and everything that's repetitive should absolutely, positively be a macro: text, such as the ending of a letter or boilerplate paragraphs; or the keystrokes involved in taking the inside address from a letter and printing it on an envelope.

What follows is a step-by-step guide to the creation of eight macros I consider basic to any business environment: a city, state, ZIP macro, a letter-skeleton macro, a letter-end macro, an envelope-addressing macro (it takes the address from a letter and prints it on an envelope), a macro that will print the entire document, a macro that sends the current page to the printer, and a pair of macros to reverse the reverse-order output of an HP Laserjet printer.

These eight barely scratch the surface of what WordPerfect macros can do for you and your business; there is truly no end to what can be done with them.

The macros were written with Version 4.2 of WordPerfect and have also been tested on Version 4.1. They assume that the standard settings are in effect and that WordPerfect, not the printer, controls the top margin. If your printer controls the top margin, set WordPerfect's top margin to 0 and adjust the following macros accordingly. On some instruction lines, such as "Hold Shift and tap F7 (the WordPerfect Print key)," the text in parentheses is either the WordPerfect name for the key or a terse explanation of what you are doing.

If you write the macros to a floppy disk (or hard disk directory) that contains the WordPerfect WP.EXE file (probably \wp if you used WordPerfect's suggestion), they'll be available to you at all times.

There are two ways to name and use macros. To name (or define) macros, which you do immediately after starting the macro definition, you either hold Alt and tap a single letter from A to Z, which allows 26 macros, Alt-A to Alt-Z, or you just type the macro name (two to eight letters) and then tap Enter.

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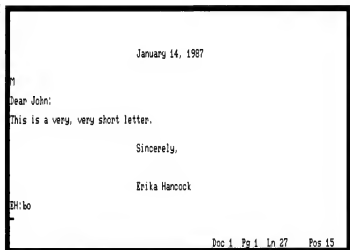
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## ■ IMPROVING WORDPERFECT



You can create a macro that will save you from repeating keystrokes for the standard portions of a letter, such as margins and dates. The screen shown here was executed in less than one second.

For example, to use or invoke a macro named Alt-N, you hold down the Alt key and tap the single letter N. To invoke a macro named LETTER, hold Alt and tap F10, type LETTER, and then tap Enter. A macro cannot be named Alt-AZ (Alt + two letters), nor is a macro a document that can be retrieved—it is a series of recorded keystrokes saved as a file with the (automatic) extension .MAC. For example, the macro Alt-N would appear in the List Files Directory (F5-Enter) as AltN.MAC, and the LETTER macro would appear as LETTER.MAC.

If you make a mistake and need to start over, type Ctrl-F10 to end the macro, then Ctrl-F10 to restart it. If you're redefining the same key, WordPerfect asks if you want to overwrite the existing macro. Type Y for yes.

There is nothing magical about macros after they have landed on-screen—at that point they are, for all intents and purposes, characters you typed, and they can be edited in any way you like. Each time a macro is invoked it comes up just as it did when you originally wrote it.

**A CITY, STATE, ZIP MACRO** If you correspond frequently with clients or colleagues in one city or town, why not turn

the city, state, ZIP line into a macro? The total number of keystrokes involved can be reduced from about two dozen to two.

The Alt-N macro will place "New York, New York 100" on your screen. To write it, follow the steps below, beginning with a clear WordPerfect screen.

1. Hold Ctrl and tap F10 (Ctrl-F10 begins and ends a macro definition in WordPerfect). The PC prompts Define Macro: which means "Give the macro a name."

2. Hold Alt and tap the letter N (for New York). The system will begin blinking Macro Def in the lower left-hand corner of the screen. Everything you type from this point until you end the macro definition will be recorded.

3. Type "New York, New York 100" but don't press the Enter key.

4. Hold Ctrl and tap F10 (to end the definition of the Alt-N macro). The reason you stop typing after three digits of the ZIP code is that when a macro is invoked, or used, the cursor will appear on-screen where it was left in the definition. In this example, the cursor will be waiting exactly where you begin typing the last two digits of the ZIP. (If you're writing to a smaller city or town where the ZIP code is the same all over town, you can type in the full ZIP code and then press Enter.)

5. Clear the screen by tapping F7, N, N. As soon as you tap the F7 (Exit) key, the system will ask if you want to Save the document and if you want to quit WordPerfect. You respond with N—for No—because the macro was already saved when you ended the definition by holding Ctrl and tapping F10. The document is not the macro.

6. Try it out: just tap Alt-N. You're on your way.

### THE LETTER-SKELETON MACRO

Much of every letter you write is the same—the left and right margins, the top and bottom margins, the location of the date. Because the keystrokes involved are repeated with every letter, your letter "skeleton" is definitely a candidate for a macro.

Because the letter-skeleton macro (Alt-L) is totally generic, feel free to change the text or formatting to suit your specific needs and/or whims. If you send out letters that are all the same except for the names and addresses, the whole letter could be in the macro.

If you're going to use this macro, your computer should always know the date and time (the macro pulls the date—right or wrong—from the system). If you don't have a clock-calendar built in, set the date when you turn your PC on.

To create the Alt-L macro, begin with a clear screen (if it's not blank, clear it by simply tapping F7, N, N (for exit, save-no, exit-no).

1. Hold Ctrl and tap F10 (begin the definition of the macro). The system prompts Define Macro: (give the macro a name).

2. Hold Alt and tap the letter L (for letter). The system blinks Macro Def in the lower left-hand corner of the screen, which means that everything you type from this point until you end the macro definition will be recorded.

3. Hold Shift and tap F8 (the WordPerfect Line Format key). You'll see a formatting line at the bottom of the screen.

4. Tap 3 (margins).

5. Type 15 (for the left margin) and tap Enter. (You may prefer a different left margin.)

6. Type 70 (for the right margin) and tap Enter.

7. Hold Ctrl and tap F8 (the WordPer-

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## ■ IMPROVING WORDPERFECT

fect Print Format key; you'll see a format menu come on-screen).

8. Tap 1 (for pitch and font).

9. Type 10 (for characters per inch) and tap Enter.

10. Tap 1 (for font 1) and tap Enter.

11. Tap Enter (to exit the print format menu).

12. This step allows for the space taken by a company letterhead on stationery. Find one of your existing letters and measure the distance from the top of the page to the line on which the date appears. Let's say the distance is 2½ inches (a typical amount). At the standard 6 lines per inch, that translates to 15 lines.

Subtracting the default WordPerfect 6-line (1-inch) top margin from 15 lines leaves 9 lines. Tap the Enter key nine times.

13. Spacebar out to position 45 (watch the bottom right of your screen, which shows the position).

14. Hold Shift and tap F5 (the WordPerfect Date key).

15. Tap 2 (format).

16. To format the way the date will automatically appear on your letter (e.g., April 28, 1987), tap 3, tap the Spacebar, tap 1, tap comma, tap the Spacebar, and then tap 4.

17. Next tap Enter to finalize the date format.

18. Tap 1 (insert text) to place the date on-screen (it will always be the current date, not when you created the macro).

19. Tap Enter three times.

20. Tap the letter M (for Mr., Mrs., Ms.) and tap Enter twice.

21. Type Dear and tap the Spacebar once (trust me, I know what I'm doing!).

22. Tap the Cursor Up key, then the Cursor Left key—which will place the cursor to the right of the M. In defining a macro, you leave the cursor where you want it to be when you invoke the macro. (This instruction typifies the subtle ways programs change from version to version. In WordPerfect, Version 4.2, you can use the keystrokes listed or substitute two Cursor Up keystrokes, but in 4.1 you have to type Cursor up, Cursor Left.)

23. Hold Ctrl and tap F10 (to end the definition of the Alt-L macro).

24. Clear your screen without saving the document (F7, N, N). Remember that

■ Many users just don't know how to get the PC to address an envelope. The Alt-E macro takes the inside address of the on-screen letter and places it on an envelope.

you are only clearing the screen, not erasing the macro, which was saved to disk in the previous step.

**THE LETTER-END MACRO** To create a macro that ends the letter (Alt-F10, XX, Enter, where XX is the author's initials), follow the steps below in exact sequence from a clear screen. You can write a different closing macro for each person who signs letters.

1. Hold Alt and tap the letter L (to invoke the letter-skeleton macro). The letter skeleton will appear on screen with the cursor waiting after the M.

2. Tap the PgDn key, which for now will bypass having to enter an inside address and take you immediately to the end of the Dear line.

3. Type John; tap Enter twice, and then type "This is a very, very short letter."

Do not tap Enter at the end of the sentence. If you did, just tap the Backspace key and the cursor will return to the position after the period.

4. Hit Ctrl-F10 (to begin the definition of the macro). The system will prompt Define Macro:.

5. Type in your initials (e.g., RM for Rhyder McClure) and tap Enter. The system will blink Macro Def in the lower left-hand corner of the screen. Everything you type from this point be recorded.

6. Tap Enter three times.

7. Hold Shift and tap F8 (the WordPerfect Line Format key).

8. Tap 3 (margins).

9. Type 15 (for the left margin) and tap Enter.

10. Type 85 (for the right margin) and tap Enter.

11. Tap the Spacebar out to position 45 and type in the ending (i.e., "Sincerely," "All good wishes," "Best regards," etc.).

12. Tap Enter four times and tap the Spacebar out to position 45.

13. Type in the name of the letter's author and tap Enter.

14. Tap the Spacebar out to position 45 and type in the title of the letter's author.

15. Tap Enter twice.

16. Type the initials of the letter's author in uppercase, a colon, and the initials of the secretary in lowercase, and then tap Enter.

17. If more than half your letters contain enclosures, type "enclosure." If less than half contain enclosures, don't type anything.

18. Hold Ctrl and tap F10 (to end the definition of the letter-end macro).

19. Clear the screen without saving the document (F7, N, N).

20. Return to step 1 if there is a need for other letter-end macros and use the initials of any other letter signers for the macro names.

The letter ending can be included in the letter-skeleton macro if there is just one letter writer.

### ENVELOPE-ADDRESSING MACRO

As a PC consultant, I'm always surprised to encounter a PC that doesn't have an electric typewriter as an appendage. Many users just don't know how to get the PC to address an envelope. The envelope-addressing macro (Alt-E) takes the inside address of the on-screen letter and places it on column 40 of an envelope.

1. From a clear screen, hold Alt and tap the letter L (to invoke the letter-skeleton macro). The letter skeleton will appear on screen with the cursor waiting after the M (for Mr., Mrs., or Ms.).

2. Type r. John Doe and tap Enter.

3. Type 123 Main Street and tap Enter.

4. Type San Francisco, CA 94115 but don't tap Enter. (If you did tap Enter, just tap the Backspace key, and the cursor will return to the end of the ZIP code.)

5. To get from the end of the ZIP to the

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## ■ IMPROVING WORDPERFECT

correct position on the Dear line, tap the PgDn key.

6. Type John: but don't bother to tap Enter after John—we're just using the inside address to create the envelope macro.

7. The next step is to place the cursor on the M in Mr. John Doe.

8. Hold Ctrl and tap F10 (to begin the definition of a macro). The system will prompt Define Macro.

9. Hold the Alt key and tap the letter E (for envelope). The system will begin blinking Macro Def in the lower left-hand corner of the screen, which means that everything you type from this point until you end the macro definition will be recorded.

10. Hold Shift and tap F8 (the WordPerfect Line Format key).

11. Tap 3 (margins).

12. Type 40 (for the left margin) and tap Enter.

13. Type 123 (for the right margin) and tap Enter.

14. Hold Alt and tap F8 (the WordPerfect Page Format key).

15. Tap 5 (top margin).

16. Type 0 and tap Enter (to set the top margin to zero).

17. Tap Enter (to exit the page format menu).

18. Hold Alt and tap F4 (to turn on the Block feature).

19. Tap F2 (the WordPerfect Forward Search key). The system will prompt -> Srch: on the bottom left of the screen.

20. Tap Enter twice. The system will now prompt -> Srch: [HRT][HRT]. (You're searching for a pair of hard carriage returns. "[HRT]," including the brackets, is WordPerfect's hard carriage return.)

21. Tap F2 (to execute the search). The entire inside address will now be blocked and the cursor will be located under the D in Dear.

22. With your printer turned on and loaded with an envelope rolled into position, hold Shift and tap F7 (the WordPerfect Print key). The system will prompt: Print Block? (Y/N) N.

23. Tap Y (for yes) right over the N, and the inside address will go right to the printer.

24. Tap F1 (to turn off the block).

25. Hold Shift and tap F2 (the WordPerfect Reverse Search key). The system

## WHY NOT SUPERKEY?

Rather than use the WordPerfect macro capability, you could call on one of the external, memory-resident keyboard macro programs, such as SuperKey, ProKey, Keyworks, or SmartKey. But why bother?

The WordPerfect macro capability doesn't cost anything extra, it's always available (unlike a ProKey you may forget to load), there's no possible conflict with other RAM-resident programs, and it's easy to learn (unlike 1-2-3's macro facilities).

If you're using WordStar or another word processor without a macro capability, there's no choice but to buy an add-on. (For a rundown on keyboard macro programs, see "Power Plays at Your Keyboard," PC Magazine, Volume 4 Number 22.)

External programs are not without their advantages: more macros available with single keystroke combinations (WordPerfect stops at 26), the ability to

switch among sets of macros, and easier macro editing (most others are text files: WordPerfect macros need the \$129 WordPerfect Library). And external programs such as Keyworks even allow you to choose macros from a menu; with WordPerfect, you have to remember what you've assigned to each key.

If your aim is to save keystrokes, another method is through an abbreviations-into-words expander such as PRD+. As you type keystrokes into your word processor, when PRD+ recognizes a string of characters you've predefined as a phrase, it substitutes the phrase. For instance, if you type "asap," PRD+ could be programmed to insert "Please advise us of your intentions as soon as possible and in any case within 30 days." You can have several hundred phrases on call, and predefined phrase lists are available for most major professions such as law or real estate.

—Bill Howard

will prompt <- Srch: [HRT][HRT]. (WordPerfect remembers what it last searched for.)

26. Hold Alt, tap F8, and then tap 5 (to tell the system to Reverse Search for the top margin code you inserted in steps 14 through 16).

27. Tap F2 (to execute the reverse search).

28. Tap the Backspace key (the key that deletes the character to the left of the cursor). On the bottom left of the screen the system will prompt Delete [Top Mar]? (Y/N) N.

29. Tap Y right through the N.

30. Tap the Backspace key again. The system will prompt: Delete [Margin Set]? (Y/N) N.

31. Tap Y right through the N.

32. Hold Ctrl and tap F3 (the WordPerfect Screen key).

33. Tap Enter (to rewrite the screen).

34. Hold Ctrl and tap F10 (to end the definition of the Alt-E macro).

35. Clear the screen without saving the

document (F7, N, N); the macro was saved with Ctrl-F10.

To invoke the Alt-E macro, refer to steps 8 through 10 in "Testing the Macros" below.

There are variations of the Alt-E macro, for instance, to address the envelope as you type the letter, to print an envelope on a laser printer (which requires more precise positioning, since you can't just crank the envelope in until it lines up), or to add your own return address (or just your name if the envelope has a company logo and address in the corner).

### DOCUMENT-PRINTING MACRO

The Alt-D macro will print an entire multiple-on-screen document from page 1.

1. From a clear screen, and with the printer turned on and loaded with paper, type "Today we are creating some extremely useful macros."

2. Hold Ctrl and tap Enter, WordPerfect's command to force a page break, and then simply type "I knew WordPerfect

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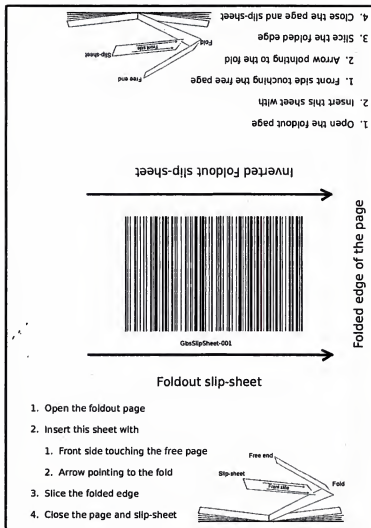
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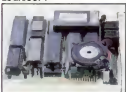
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## ■ IMPROVING WORDPERFECT

made life easier, but this is wonderful!"

3. Hold Ctrl and tap F10 to begin the definition of the macro. The system will prompt Define Macro:

4. Hold Alt and tap D (for document). The system will blink Macro Def in the lower left-hand corner of the screen.

5. Hold Shift and tap F7 (the *WordPerfect* Print key).

6. Tap 1 (full text). Two pages, with the lines from steps 1 and 2, will be printed.

7. Hold Ctrl and tap F10 (to end the definition of the Alt-D macro).

### CURRENT-PAGE-PRINTING MACRO

The Alt-P macro will print the current page—displayed as Pg XX on the status line on the bottom right of the screen.

1. From a clear screen, and with the printer turned on and loaded with paper, type "Today we are creating some extremely useful macros."

2. Hold Ctrl and tap Enter to force a page break, and then type "I knew WordPerfect made life easier, but this is wonderful!" (If the phrase makes you gag, substitute something else.)

3. Hold Ctrl and tap F10 (to begin the definition of the macro). The system will prompt Define Macro:

4. Hold Alt and tap P (for page). The system will begin blinking Macro Def in the lower left-hand corner of the screen.

5. Hold Shift and tap F7 (the *WordPerfect* Print key).

6. Tap 2 (page). Page 2 (Pg 2 on the Status line), with the line from step 2, will print.

7. Hold Ctrl and tap F10 (to end the definition of the Alt-P macro).

### RIGHT-ORDER LASERJET PRINTING

If you have an HP Laserjet or compatible, these two macros, ALTR.MAC and REV.MAC, work together to print your document so the first page is on top and the last page is on the bottom. The macros are chained and must be stored on the same disk, or in the same hard disk directory, as the WP.EXE file (probably \WP).

The speed with which the reverse-order macro pair works depends on the speed of your system and the size of the document to be printed.

1. From a clear screen, hold Ctrl and tap F10 to begin the macro definition.

■ If you discover that a macro doesn't work the way you expected it to, or if you got lost in writing a macro, just rewrite it from the beginning.

2. The system responds Define Macro:  
3. Hold Alt and tap R.

4. "Macro Def" will begin blinking at the bottom of your screen.

5. Tap the Esc key, and you will see n = 8 on the bottom left of your screen.

6. Hold Ctrl and tap PgUp, and the system will beep.

7. Tap Enter twice.

8. Hold Alt and tap F10 and the system will prompt Macro:

9. Type REV and tap Enter.

10. Hold Ctrl and tap F10 to end the definition of the Alt-R macro.

11. Hold Ctrl and tap F10 to begin the definition of the REV macro.

12. System responds Define Macro:

13. Type REV and tap Enter.

14. Macro Def blinks at the bottom of your screen.

15. Hold Shift and tap F7.

16. System responds: 1 Full Text; 2 Page; 3 Options; 4 Printer Control; 5 Type-thru; 6 Preview; 0.

17. Select 2 (Page).

18. Tap PgUp.

19. Hold Ctrl and tap F10 to end the definition of the REV macro.

**TESTING THE MACROS** Now that your struggles as a macro writer are over, it's time to test the results. If you discover that a macro doesn't work the way you expected it to, or if you got lost in writing a macro, just rewrite it from the beginning. When you give it the rewrite a name (if it's the same as the original), the system will ask if you want to replace the original. All

you have to do is tap Y for yes, and continue on your way.

1. From a clear screen, hold Alt and tap the letter L (to invoke the letter-skeleton macro, which includes today's date and places the cursor on the position directly after the M).

2. Type in the name of an imaginary colleague (if the addressee is not a Mr., Mrs., or Ms., backspace to erase the M and type the appropriate letter, D for Doctor, P for Professor, etc., and type in the rest of the name) then tap Enter.

3. Type in the rest of address through the ZIP (using the Alt-N macro for the city, state, and ZIP) and stop.

4. The only trick to the Alt-L macro is getting from the end of the ZIP code to the correct place on the Dear line, which you do by tapping the PgDn key, if there is no Re: line. If there is a Re: line then you must tap Enter two times after the ZIP code, then Tab or Spacebar to the correct position and type Re: Whatever. Then tap the PgDn key to get to the correct position on the Dear line.

Since there is no Re: line in this test, just tap the PgDn key, which will correctly position the cursor on the Dear line.

5. Type in the first name of the colleague followed by a colon and two taps of the Enter key.

6. Next type two short paragraphs. However, don't hit the Enter key to end the last paragraph.

7. Immediately after the end punctuation of the last paragraph, invoke the closing macro by holding Alt and tapping F10. The system will prompt Macro: Type in your initials (or those you used to name the letter-end macro) and tap Enter.

8. To address the envelope using the inside address on the letter, first place an envelope in the printer and roll it up to the line on which you want printing to begin. There's usually a ruler line on the printer. Line up the left side of the envelope with the zero mark.

9. Place the cursor on the first letter of the inside address (i.e., on the M in Ms. Jane Doe).

10. Hold Alt and tap E (to invoke the envelope Macro).

11. To print the letter, make certain there is paper in the printer, then hold Alt and tap P (for print the page) or D (for print

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## ■ WORDPERFECT

- You can force pauses during macro execution that let you insert either a fixed or varying number of keystrokes, then resume execution.

the document) if it's over a page long.

12. To use the reverse-order macro, Load a multiple-page document into *WordPerfect*. Place the cursor on the last page of the document (Home, Home, Cursor Down will get you there quickly). If you don't want to print the entire document, place the cursor anywhere on the last page you want printed.

13. Note the page number.

14. Hold Alt and tap R. The system will prompt n = 8. Type the number of the last page and tap Enter. The printout will land in the output bin with page 1 on top.

The examples above will get you thinking about and writing macros of your own. *WordPerfect* macros can do anything the program can. You can force pauses during macro execution that let you insert either a fixed or varying number of keystrokes, then resume the macro.

To further pique your interest, let me suggest a useful project—write a macro (Alt-K) that will kill the current print job and also clear the print queue. Or, if you have a printer with a multiple-bin sheet feeder, consider writing a macro that prints the letter from the first bin, then addresses an envelope from the second bin.

*If you develop useful WordPerfect macros that have broad applications, send them to PC Magazine's Power User column. We'll publish the best ones and pay you \$50 to \$300.—Ed.]*

*Rhyder McClure is a New York City computer consultant and author of an upcoming book on WordPerfect.*

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# Think You Need an AT?

# Think Again.

## TABLE OF BENCHMARK RESULTS

This table shows the results of the processor/coprocessor speed tests using the April 1986 release of PC Magazine's 'PC Labs Benchmark Tests'. These are public domain programs, and are available on diskette

from PC Magazine, or via the PC Magazine bulletin board. These results were obtained by us at PCSG, and are not yet official published PC Magazine figures.

The last line in the table, the

Norton System Information Test, is not from PC Magazine, but is part of the popular 'Norton Utilities.' The version we used was 3.1, which is the latest version but may not give identical results to older versions.

	IBM PC	IBM AT	BREAKTHRU	286
Clock speed in MHz (IBM PC is 4.77)	4.77	6	8	12
Empty Loop	1	1.99	3.34	5.0
Integer add from memory	1	3.35	4.41	5.8
Integer multiply from memory	1	6.06	6.55	8.3
Floating point without coprocessor	1	3.33	4.42	5.5
Prime number test	1	1.95	2.85	3.7
Lotus 123 macro (640K)	1	2.64	3.69	4.62
Lotus 123 macro (256K)	1	1.77	3.54	4.38
Norton System Information Test	1	5.73	7.34	10.1

In every case but clock speed the numbers indicate how many times faster a test is performed than on a regular IBM PC.

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Breakthru 286 (8MHz)	\$395	7.3 X faster
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<b>LIGHTNING™</b> speedup software	FREE with Breakthru \$89.95 purchased separately	

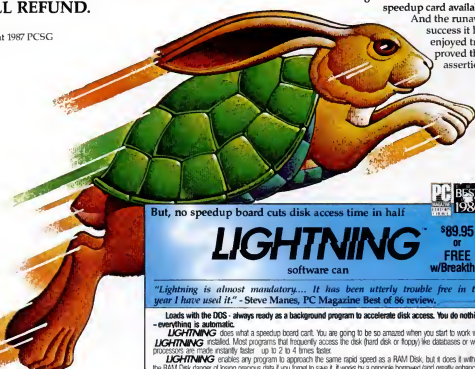
**DON'T TAKE OUR WORD FOR IT. USE EITHER BREAKTHRU 286 SPEEDUP BOARD FOR 60 DAYS. IF YOU ARE NOT TOTALLY SATISFIED SIMPLY RETURN FOR A FULL REFUND.**

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We are excited about our three speedup products. You probably know about our Lightning disk access speedup software that was awarded PC magazine's Best of 1986 award (see box). After the smashing success of Lightning, we developed the Breakthru 286 board to be literally the most advanced, fastest, most feature-rich board available. Now we go ourselves one better with the Breakthru 286-12. This new board has the clock speed cranked up from 8 to 12 MHz for speeds up to 10.1 times faster than an IBM PC.

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**Fourth, these are the best.** There are several other boards on the market. We at PCSG have compared them all, but there simply is no comparison. What we discovered is that many cards being sold offer only a marginal speedup in spite of their claims and others are just poorly engineered. For example some boards have a cumbersome mechanical switch for going back to 8088 speed, but the Breakthru boards have speed switching software that allows you to drop back to a lower speed on the fly for timing sensitive applications. The 8MHz BREAKTHRU 286 and the 12MHz are unequivocally the best executed and most completely reliable speedup boards manufactured today.

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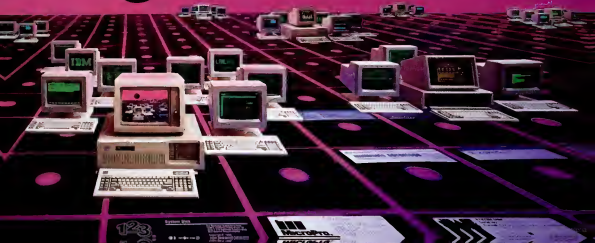
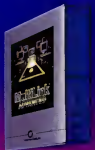
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## 3Com's Ethernet and Token-Ring

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**T**hough its products have been very successful in the LAN marketplace, 3Com Corp. is not content to rest on past triumphs. Ethernet is currently the most popular network system for the PC, but 3Com now offers an additional network, Token-Ring, plus a new version of 3+Share (pronounced *three share*; the "plus" is silent), its networking software, and 3Server3, a new network server.

Robert Metcalfe, 3Com's cofounder and chairman, was deeply involved in the development of the Ethernet standard, which, in terms of an installed base, is the most widely accepted standard among all computer systems. Many large corporate and government network acquisitions mandate the use

The Ethernet and Token-Ring networks stand out in our continuing series on connectivity for excellent performance, features, and flexibility. One works best in busier environments, and one in more-typical office settings. Have we finally found another contender for the top LAN choice?

■ FRANK J. DERFLER, JR.

of the Ethernet standard for three reasons: Ethernet was one of the earliest of the formally accepted networking standards (IEEE 802.3); Ethernet interfaces are available for many different kinds of computers; and Ethernet's specifications indicate that it has very fast transmission speed (10 megabits per second).

Ethernet's network interface cards use the Ethernet protocols for signaling, identifying workstations, and managing networks. But despite Ethernet's success, 3Com could not rest on its laurels, or on Ethernet alone.

IBM Corp. is making steady progress in the marketplace with its Token-Ring Network, which seems destined to be a major portal between PCs and main-frame systems. Technically,



## ■ 3COM'S ETHERNET AND TOKEN-RING

token-passing network access protocols like those used in the IBM Token-Ring Network have some advantages in heavily loaded networks over the listen-and-transmit protocols used in Ethernet. 3Com has responded with its Token-Ring, a new network using its own form of token-ring technology. 3Com's Token-Ring is compatible with (but not a clone of) IBM's network, and it complements Ethernet.

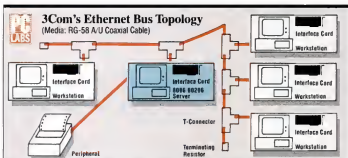
The 3Com Token-Ring and Ethernet product lines consist of network interface cards, connecting cables, and networking software. The Ethernet network uses the EtherLink card; the 3Com Token-Ring network uses the TokenLink Plus card. Any PC in the class of the XT or AT can act as the server for either network. 3Com's own 3Server3, which both Ethernet and 3Com Token-Ring can use, is a compact, stylish machine that uses the Intel 80186 processor. The Ethernet and 3Com Token-Ring systems form an effective product line, giving 3Com the ability to solve almost any PC connectivity problem.

This review reports on both 3Com networks, which we looked at in several ways. First, we tested both the TokenLink Plus card and the EtherLink card running under 3+Share on the 3Server3. Then, for comparison, we tested the EtherLink card (we used the more expensive, high-performance EtherLink Plus card to optimize the AT's performance) running under 3+Share and using Ethernet cables on an IBM PC AT running at 8 MHz.

**ETHERNET** The classic Ethernet networking system has several options and configurations. For Ethernet, 3Com adapted the Ethernet standard cable/tap/stub scheme (see diagram).

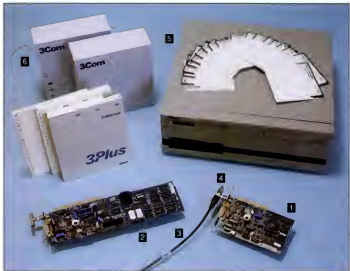
Technically, all Ethernet systems use the CSMA/CD (carrier sense multiple access with collision detection) media-sharing scheme. This is the "listen before talk" scheme that avoids the data-transmission overhead found in systems like the token ring, but it may break down under very busy workload conditions.

3Com's implementation of Ethernet cabling differs from the Ethernet standard in ways that reduce costs. Ethernet standard cabling includes thick cable for long runs (the "cable bus") and for vertical connections between floors of buildings. Net-



An Ethernet system includes the following: either (1) a half-size EtherLink network interface card for each station with a single coaxial connector and many jumpers or (2) a full-size EtherLink Plus card for computers using the PC AT bus.

Physically, Ethernet uses an arrangement in which (3) the RG-58 A/U coaxial bus cable attached to the EtherLink network interface card by a T-connector. The cable is terminated at each end with (4) a special coaxial resistor. We used (5) the 3Server3 running (6) 3+Share networking software for the testing. Electrically, the system is a bus with every station connected all the time. Stations listen to the bus channel and transmit when it is clear.



works using thick cable normally have taps attached to the cable with thinner cable (called "stubs") running to each workstation or other network node.

Ethernet PC networks use so-called thin Ethernet cable ( $\frac{1}{4}$  inch) to form a cable bus without stubs. Two cables run to each workstation and attach to the network interface card through a T-connector. The network must be terminated at each end

with a special "silver bullet" terminating resistor, and one of these resistors must be electrically grounded. This method of arranging the cables reduces cable and installation costs over the traditional Ethernet bus-and-stubs configuration.

Two industry giants, AT&T and IBM, recently emphasized the important advantages of LAN installations that use a wiring hub, in which a single cable runs from

each workstation to a common point. Since you can disconnect each station at the hub, you can diagnose a wiring problem without having to disassemble large parts of the network. The network hub arrangement thus simplifies troubleshooting of the network cabling, an increasingly important feature for commercial network installations. (For more information, see the review of AT&T Information Systems' StarLAN in "Making Connections: LANs Under NetWare," *PC Magazine*, Volume 5 Number 21.)

3Com responded to the trend toward centralized wiring systems by announcing a version of its EtherLink network interface cards able to work through a central wiring hub. Though *PC Magazine* tested the 3Com network in the daisy-chain configuration, firms considering new network installations should carefully examine the hub alternative.

**ETHERLINK CARDS** More than 750,000 EtherLink cards, several versions of which have been marketed, have been sold since 1982. 3Com's Bob Metcalfe tells us that the company is currently shipping 15,000 EtherLink cards a month.

The EtherLink network interface card now sold for use in standard IBM PCs is a \$595 half-size card with a single coaxial connector and many jumpers. A new card, the EtherLink Plus, is available for computers using the PC AT bus. This full-size

card carries its own 80186 microprocessor and RAM and costs \$895. The EtherLink Plus card can be jumpered to respond to the faster interrupts available on the AT bus. Used in a server, the EtherLink Plus can improve the performance of the entire network.

All EtherLink cards include an Ethernet transceiver chip and support circuitry. Every card has a unique Ethernet address. The unique but standardized Ethernet ad-

## ■ The Ethernet and 3Com Token-Ring systems form an effective product line, giving 3Com the ability to solve almost any connectivity problem.

dress means that the EtherLink cards can be used on larger Ethernet networks and interact with products from other manufacturers. This address is normally invisible to the user of the system, but certain diagnostic and network control programs show the Ethernet addresses on the network.

You can usually install the EtherLink cards in a standard IBM PC just as they come out of the box, but you can also use jumpers to make changes in the address, interrupts, or DMA channel used by the card. This option is both a blessing and a curse. You have the flexibility to make the card compatible with many systems, but to make a change, you have to puzzle your way through three card versions and over 40 jumpers. Our advice is to make only changes that are absolutely necessary and to document them at a central point or on a tag attached to each card. Overall, though, the Ethernet cabling and EtherLink cards are easy to install if you take care with such details as card jumpers and be sure to use the network terminators properly.

**3COM TOKEN-RING** A diagram of the 3Com Token-Ring network looks very different from the diagram of the IBM Token-

Ring Network (*PC Magazine*, Volume 6 Number 1, page 229), but electrically, the networks operate the same way. A special message called a token is passed from station to station on the network ring. When a station receives a token, it is free to enter a message addressed to a specific station into the network. The receiving station generates a new token on the network. Under this system, every station on a 3Com Token-Ring or IBM Token-Ring Network receives an equal opportunity to transmit, even in heavily loaded conditions.

In the IBM Token-Ring Network system, each station is connected to a central hub, and a physical diagram of the system looks more like a star than a ring. Because of the need to run a cable to each workstation, this arrangement requires the use of more cable than a daisy-chain system. However, if one cable in the IBM system is severed or shorted or one workstation network interface card becomes defective, the network should continue to operate because the bad connection will be dropped out of the network by the hub.

Physically, the 3Com Token-Ring system looks like a classic Ethernet installation with a main cable, taps, and stubs. A thick main bus cable runs between devices 3Com calls RingTaps. Each RingTap has a station cable that connects to an individual station. The RingTap associated with the last station on each end of the network must be terminated in a special device called a loopback. Instead of being a true circular ring, the 3Com Token-Ring is actually a squashed ellipse. The loopback device at each end routes the messages back down the cable instead of sending them all the way around a ring.

Each RingTap houses solenoids that make network connections. If the station attached to the RingTap is active, the messages on the ring are routed to it. If the RingTap's station is inactive or the station cable is damaged, the RingTap passes the messages straight on down the network. When a workstation enters the network, you hear a faint click as the connection is made inside the RingTap.

Connecting the RingTaps correctly takes some care. The RingTaps in the middle all connect the same way, but you have to turn around the last RingTap at each end of the chain before terminating it. If you



### FACT FILE

#### Ethernet

3Com Corp.  
1365 Shorebird Way  
Mountain View, CA 94039  
(415) 961-9602

**Workstation Requirements:** 320K RAM, DOS 3.1 or later.

**Server Requirements:** 640K RAM, DOS 3.1 or later.

**Networking Software:** 3+Share.

**List Prices:** EtherLink cards, \$595 each; terminator kit, \$50; cable prices vary depending on length; 3+Share for PC servers (maximum of five users), \$895; 3+Share for 3Server3 (unlimited number of users), \$1,790; 3Server3, \$5,995.

CIRCLE 66 ON READER SERVICE CARD

## ■ 3COM'S ETHERNET AND TOKEN-RING

don't do this right, the workstations at the ends of the network are looped back to themselves and the rest of the network is open. The results are difficult to predict, but certainly there will be something that just won't work right.

The \$1,095 TokenLink Plus cards resemble the EtherLink Plus cards in that each card has its own Intel 80186 microprocessor, programming in ROM, and on-board RAM to remove the load from the processor in the PC workstation. These cards are all capable of operating on the 16-bit bus of the PC AT and using its faster interrupts. You can also use them in standard 8-bit PC systems.

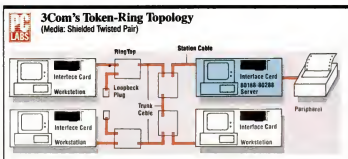
3Com's attention to detail produced a better token-ring product than IBM's in many ways. The connectors have large captive screws that you can turn with your fingers instead of a jeweler's screwdriver. You don't have to realign the solenoids in the RingTaps after moving something in the network, as you do with the IBM system. You can add stations to the ring without having to buy another network hub. And once you get the 3Com system together, it works well.

### COMPARISONS AND CONTRASTS

Any comparison of the cost or complexity of 3Com's Ethernet, the IBM Token-Ring Network, or the 3Com Token-Ring must be made on the basis of a specific installation. Depending on the distance between stations, the number of stations, the electrical and physical environments, and the uses of the network, no one system is always more economical, more effective, or easier to install.

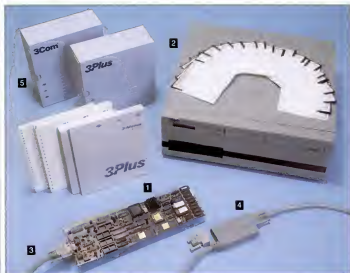
3Com's Ethernet network requires two pieces of small coaxial cable to be run to every station on the network except the two stations at the ends. The total cable length is limited (usually 1,000 feet, depending on the cable used), and adding a station to the middle of the bus can involve a long run of two cables. If the cable breaks or shorts anywhere, the entire network goes down.

The IBM Token-Ring Network uses a single large-diameter (3/4-inch) cable to connect each workstation, but each cable must go all the way back to a central point, where the wiring hub is located. Expansion is limited by the number of free ports



The 3Com Token-Ring system is made up of (1) a TokenLink Plus network interface card for each station, (2) the 3Server3, (3) the 3Com RingTaps and trunk cables, and (4) a loopback plug used at each end of the network. We ran the system under (5) 3+Share.

Physically, the 3Com Token-Ring system resembles an Ethernet system with main trunk cables, cable taps, and stubs leading to station cables. Electrically, it is a squashed ellipse: The signals are routed to active stations by RingTaps that contain solenoids activated by the end station. At the end of the network, special loopback plugs return the electrical messages back down the line.



on a hub. The \$660 hub can host only ten stations. A break or short in a single cable does not disable the network.

The 3Com Token-Ring does not have a wiring hub, but a large-diameter (7/16-inch) trunk cable of twisted-pair wiring goes to and from every \$95 RingTap. In a typical office environment, the RingTaps and the trunk cables are overhead in a suspended ceiling, and the station cable (3/4-inch) runs down the wall (probably inside a conduit)

to the floor, where it connects to the workstation. Adding a distant station to the middle of the network requires a run of two trunk cables, but you can add stations to either end of the network with a single trunk cable. If a 3Com Token-Ring station cable is cut or shorted, the network survives. If a trunk cable is open or shorted, the network fails.

Deciding among these systems depends as much on the support available from lo-

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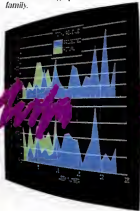
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**CIRCLE 213 ON READER SERVICE CARD**

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**Kimtron**

<sup>1</sup>Reprinted from: Computer Systems News, August 18, 1986, copyright 1986, CMP Publishing

<sup>2</sup>Special models of the KT-7/PC Version L are available for solutions such as XENIX from IBM and The Santa Cruz Operations and QNX from Quantum Corp.

## ■ 3COM'S ETHERNET AND TOKEN-RING

cal vendors and installers as it does on the technical specifications.

**3SERVER3** 3Com's \$5,995 3Server3 comes in a good-looking cabinet with a low profile and a liquid crystal display on the front panel. Inside the machine, an 8-MHz Intel 80186 processor is mated to an 82586 multibuffer DMA (direct memory access) Ethernet controller, a 70-megabyte hard disk, and 960K bytes of RAM. In its standard configuration, the 3Server3 has one Ethernet connection, one serial port, and one parallel port.

The 3Server3 has a small computer system interface (SCSI) expansion bus to interface with additional hard disk drives, tape backup, and other SCSI-compatible peripherals. An optional (\$1,495) 3Com CacheCard raises the 3Server3's RAM to 2,048K bytes of EMS memory on top of the base RAM, for a total of 3 megabytes. This cache card, required for servers that have the communications options installed, significantly decreases file access time because the disk's file allocation table is kept in RAM, along with frequently accessed data. Hard disk storage can be expanded to 910 megabytes, and a backup tape system is available.

It is difficult to describe how many workstations a server can handle in any specific situation because the load coming from each workstation can vary so much. 3Com recommends the following number

of stations per 3Server3, according to the type of application the system is being used for:

- Database software development—10 to 15 workstations
- Accounting—15 to 40 workstations
- Productivity (spreadsheets, word processing)—20 to 40 workstations

Several options for the 3Server3 are available to improve its communications

### ■ 3Com's multitasking system and concurrent I/O system look like DOS to each task but perform multiple tasks much faster.

capabilities. The 3Com Port Expansion Board adds four serial ports, a parallel printer port, and an AppleTalk connector. Two of the serial ports are asynchronous, and two are either synchronous or asynchronous. This board replaces the original rear panel of the server.

Another option that fits into the same place on the rear panel of the 3Server3 (but not at the same time as the 3Com Port Expansion Board) is the 3Com Token-Ring connection card. This card enables the 3Server3 to run in networks using IBM Token-Ring Network cards and 3Com's TokenLink Plus cards.

**RUNNING THE 3SERVER3** The 3Server3's operational controls are a power on/off switch, a test/operation toggle switch, a reset button, a "strobe" button, and a thumb-wheel switch behind the front panel. The thumb wheel selects setup, operational, and test modes on the server. The strobe button selects certain diagnostic services during test-mode operation.

One position of the 3Server3 thumb-wheel switch allows an Ethernet- or a 3Com Token-Ring-connected workstation to load network program files onto the server's hard disk and to execute those pro-

grams in the server's processor. This setup mode, used during the initial installation of the networking software on the server, allows any workstation on the network to act as a terminal for the server so that you can monitor and control the operation of the server's batch files, DOS, and the networking software.

As the server goes through its self-test and program-loading process, messages are flashed on the single-line, 16-character LED display that is on the front of the cabinet. The 3Server3's 3+Share software includes a device driver that enables an output device called LCD. This command works the same way as the familiar PRN and CON statements operate in DOS. It allows a message from a DOS batch file to be directed to the LCD. You can edit the script files used in the 3Server3 in order to send additional status and error messages to the display so that you can monitor operating conditions visually.

**NETWORKING SOFTWARE** The overall 3Com networking software package is called 3Plus. The major part of the software, however, is the file-sharing and -naming software called 3+Share. You can use one \$895 3+Share package for your PC AT server to establish one to five workstations; buying another 3+Share package for your PC AT server gives you support of unlimited workstations. The \$1,790 3+Share package designed for the 3Server3 supports unlimited workstations.

To understand the design of 3Com's networking software, think of it in terms of what executes on each user's workstation and what executes on the file server. Like IBM's *PC Local Area Network Program* and AT&T's DOS version of *StarLAN Network Program*, 3+Share uses the MS-DOS user-side multiuser file system interface, the Redirector (which intercepts interrupt 21), under license from Microsoft. 3+Share uses little else of MS-NET or MS-DOS, especially on the server side, where performance matters most.

On the server, 3Com chose to use the standard MS-DOS file structure, but not MS-DOS. Instead, 3Com created a multitasking system and concurrent I/O system that look like DOS to each task but perform multiple tasks much faster. Thus you can run programs such as *The Norton*



### FACT FILE

#### 3Com Token-Ring

3Com Corp.

1365 Shorebird Way

Mountain View, CA 94039

(415) 961-9602

Workstation Requirements: 320K RAM,

DOS 3.1 or later.

Server Requirements: 640K RAM, DOS

3.1 or later.

Networking Software: 3+Share.

List Prices: Starter kit includes three Token-

Link Plus cards, three RingTaps, and two

trunk cables, \$3,755; 3+Share for PC Servers

(maximum of five users), \$895; 3+Share

for 3Server3 (unlimited number of users),

\$1,790; 3Server3, \$5,995.

CIRCLE 88 ON READER SERVICE CARD

## ■ 3COM'S ETHERNET AND TOKEN-RING



### 3Com's Ethernet and Token-Ring: Summary of Features

The features described in this table are determined largely by the networking software. For an in-depth description of the method used to evaluate each feature, see "Making Connections: LANs Under NetWare," *PC Magazine*, Volume 5 Number 21. 3Com Corp.'s networking software, 3+ Share, comes with a menu-driven installation program that makes the process relatively easy.

3+ Share's monitoring and diagnostic capabilities could stand improvement, since they provide little information to the network administrator about the functioning and workload of the network. Nor does the software provide "rude messaging." Network security is also a concern with 3+ Share, since anyone can gain access to all of the files on the server if it is booted up with a DOS disk.

Product Manufacturer Software	Ethernet 3Com Corp. 3+ Share	3Com Token-Ring 3Com Corp. 3+ Share	IBM Token-Ring Network IBM Corp. PC Local Area Network Program	IBM Token-Ring Network IBM Corp. Advanced NetWare/286A	NetWare/3-Net Novell Inc. Advanced NetWare 68	ARCnet Standard Microsystems Corp. Advanced NetWare/286
<b>INSTALLATION</b>						
Turnkey						
Menu-driven installation	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■
Documentation	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■
<b>NETWORK ADMINISTRATION</b>						
Hours per month	1.00	1.00	1.00	1.00	1.00	1.25
Status reporting	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■
Security	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■
Workstation operation	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■
<b>FEATURES</b>						
Station-to-station file transfer	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■
Printer spooling/queuing	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■
Peer-to-peer communications	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■
Network dial-in	●	●	●	●	●	●
<b>COMPATIBILITY</b>						
RAM-resident software	●	●	●	●	●	●
Smart software	●	●	●	●	●	●
iBASE III Plus	●	●	●	●	●	●
R-base Series 5000	●	●	●	●	●	●



— Indicates Editor's Choice. ●—Yes ○—No

Excellent — ■ ■ ■ ■  
Good — ■ ■ ■ ■

Fair — ■ ■ ■ ■  
Poor — ■ ■ ■ ■

**Utilities** over the network on network disks.

3+ Share offers a wide range of modern network capabilities. It allows workstation users on a 3Com network to share the disk files and the equipment resources of the network. This sharing is done through four software services that are treated as sepa-

rate functions: Name Service, File Service, Print Service, and Dial-in Remote Service.

The same machine does not have to act as server for all these functions. The Print Service could, for example, run on one PC-XT-type machine acting as a print server; the Name Service and the File Ser-

vice could simultaneously run on a PC AT acting as a file server; and the Dial-in Remote Service could run on a PC with floppy disks acting as the communications server.

Each of these machines could be configured for dual use as a workstation and a server. But in our experience, simula-



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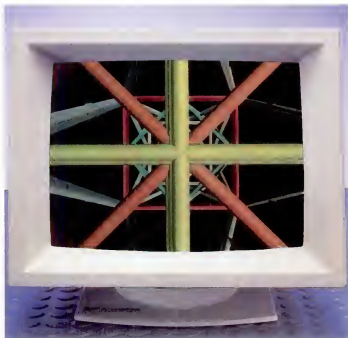


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Computer Products Division  
1255 Michael Drive  
Wood Dale, Illinois 60191.

# NEC

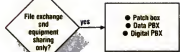
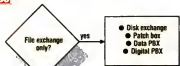




# The Connectivity Decision Guide

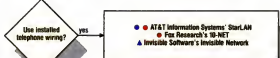
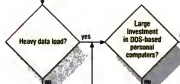
This chart is designed to help you select from among the many information-transfer and resource-sharing alternatives. As you can see on the chart, if all you really need to do is exchange files or share printers, then you should consider devices such as PBXs and patch boxes. If your organization has not already invested heavily in PCs or DOS programs, then a minicomputer might meet your needs more economically. But if you want many users to share data files simultaneously under DOS, a LAN may be the best alternative. Once you've decided on a LAN, the need for station-to-station resource sharing and other factors will influence your network purchasing decision.

Because manufacturers include many different features in their networks, some products will not fit neatly into one decision box in this guide. You'll also find that the lack of differentiation between LANs is becoming as large a problem in the LAN industry as the lack of standards was 2 years ago. But overlapping features and technical similarity between networks are good news for potential buyers. They will let you concentrate on more-traditional factors such as dealer support and price instead of on more-technical considerations.



Reviews originally appeared in PC Magazine:

- Vol. 5 No. 21
- Vol. 5 No. 22
- Vol. 6 No. 1
- Vol. 6 No. 2
- Vol. 6 No. 3
- ▲ Vol. 5 No. 4
- ▲ Vol. 5 No. 6



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## In the new world of the IBM Token-Ring network it's nice to see an old familiar face.

The Token-Ring LAN is a reality. It shouldn't surprise you that IBM<sup>®</sup> was the company that developed it. It should be equally unsurprising that the technology that best allows the Token-Ring to communicate with the mainframe comes from DCA, the makers of IRMA.<sup>™</sup>

### Introducing IRMALAN.<sup>™</sup>

IRMALAN is a new family of software and hardware products that can exploit the full power of PCs on the Token-Ring and other

NETBIOS-compatible LANS: IRMA-LAN SNA Workstation<sup>™</sup> is software that provides the PC with the 3270 functionality of IRMA; IRMALAN APA Graphics Workstation<sup>™</sup> transforms a PC on a LAN into a mainframe graphics workstation. It can also store, print, plot and redisplay graphs right at the PC.

The IRMALAN family includes gateways that connect Token-Ring networks to both DFT controllers and SDLC communication lines.

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CIRCLE 541 ON READER SERVICE CARD

## ■ 3COM'S ETHERNET AND TOKEN-RING



### Benchmark Tests: 3Com's Ethernet and Token-Ring

The critical factor for these benchmark tests is the speed degradation that the network demonstrated under load. This set of benchmark-test results shows some of the networks with the best response time we found for each. 3Com's 3Server3 makes use of 3 megabytes of RAM to cache and buffer data for the network, thereby dramatically improving the two 3Com networks' performance on the Network plus Server Cruncher test. The IBM PC AT server was limited to 512K bytes of RAM for all these tests. Novell's Advanced NetWare/286 seemed to deal with this RAM limitation better than did the IBM or 3Com networking software. The results of running 3Com's TokenLink Plus card on the IBM PC AT would most likely be very similar to those achieved with the IBM Token-Ring Network hardware and software.

#### Network Speed Under Contention

Interface card	Software	Server	Performance Times (Times given in seconds)				
			Zero stations	One station	Two stations	Three stations	Four stations
EtherLink Plus	3+ Share	8-MHz IBM PC AT	51.00	87.00	110.00	140.00	170.00
EtherLink	3+ Share	3Server3	44.00	54.00	66.00	76.00	97.00
TokenLink Plus	3+ Share	3Server3	52.00	58.00	70.00	90.00	117.00

IBM Token-Ring Network	PC Local Area Network	8-MHz IBM PC AT	63.68	71.54	83.47	97.41	110.73
IBM Token-Ring Network	Advanced NetWare/286A	8-MHz IBM PC AT	55.83	60.16	64.10	73.29	79.52
NetWare/3-Net	Advanced NetWare 68	Novell Server 688	71.00	63.70	94.29	103.71	115.68
ARCnet	Advanced NetWare/286	8-MHz IBM PC AT	59.45	62.14	67.83	78.21	92.56

#### Network plus Server Cruncher

Interface card	Software	Server	Performance Times (Times given in seconds)				
			Zero stations	One station	Two stations	Three stations	Four stations
EtherLink Plus	3+ Share	8-MHz IBM PC AT	51.00	112.00	154.00	191.00	252.00
EtherLink	3+ Share	3Server3	44.00	63.00	79.00	96.00	112.00
TokenLink Plus	3+ Share	3Server3	52.00	69.00	68.00	109.00	142.00

IBM Token-Ring Network	PC Local Area Network	8-MHz IBM PC AT	63.66	88.00	130.05	171.48	216.11
IBM Token-Ring Network	Advanced NetWare/286A	8-MHz IBM PC AT	55.83	95.68	131.18	147.97	177.52
NetWare/3-Net	Advanced NetWare 68	Novell Server 688	71.00	73.05	79.45	68.87	91.00
ARCnet	Advanced NetWare/286	8-MHz IBM PC AT	59.45	65.85	73.87	110.65	128.63

#### Smart Applications

Interface card	Software	Server	Performance Times (Times given in seconds)				
			Zero stations	One station	Two stations	Three stations	Four stations
EtherLink Plus	3+ Share	8-MHz IBM PC AT	52.00	54.00	56.00	58.00	59.00
EtherLink	3+ Share	3Server3	50.00	51.00	51.00	53.00	53.00
TokenLink Plus	3+ Share	3Server3	56.00	56.00	57.00	58.00	58.00

IBM Token-Ring Network	PC Local Area Network	8-MHz IBM PC AT	64.00	68.00	71.00	78.00	85.00
IBM Token-Ring Network	Advanced NetWare/286A	8-MHz IBM PC AT	67.00	68.00	69.00	70.00	72.00
NetWare/3-Net	Advanced NetWare 68	Novell Server 688	81.00	81.00	82.00	63.00	64.00
ARCnet	Advanced NetWare/286	8-MHz IBM PC AT	47.00	49.50	49.50	50.50	50.50

For this issue, we tested several 3Com products in different ways. First, we tested both the TokenLink Plus card and the EtherLink card with 3+ Share on the 3Server3. Then, for comparison, we loaded 3+ Share onto an IBM PC AT running at 8 MHz using the EtherLink Plus card, cables, and wiring.

The 3Com Token-Ring network operates, electrically, in the same way as the IBM Token-Ring Network. For comparison, we therefore included benchmark-test results for the IBM Token-Ring Network card with IBM's PC Local Area Network Program on an 8-MHz AT and also the results for the IBM cards with Novell's Advanced NetWare/286A on an 8-MHz AT.

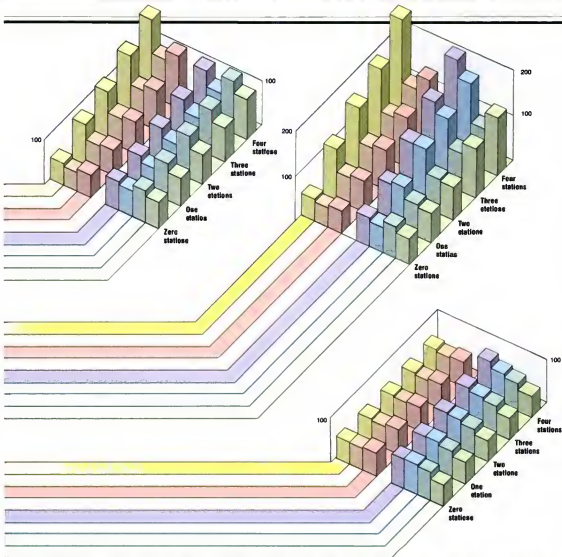
We also include the results from Editor's Choice Standard Microsystems Corp.'s ARCnet running

under Novell's Advanced NetWare/286 on an 8-MHz PC AT and the results for high-scoring Novell's NetWare/3-Net running under Advanced NetWare 68 on the Novell Server 688, a specialized Motorola 68000 server.

We configured all of the servers to operate only in the dedicated server mode and not as dual-purpose server/workstations. The benchmark tests were run using a network of three IBM PCs, one IBM PC AT, and one IBM PC-XT as workstations. All networking software was installed using the default configurations. No attempt was made to "fine-tune" the buffers or other parameters to achieve better performance on any one test.

For both the Network Speed Under Contention and Network plus Server Cruncher benchmark tests, the dependent variable is the time it took for the IBM PC-XT on a LAN to perform a standard set of DOS read-write commands against a single data file residing in the server. The independent variable is the network load. We began with the heaviest load, four network workstations running DOS batch files, asking for constant reads of data files from the server. Then we decreased the number of workstations one by one to reduce the network load.

The three-dimensional chart above shows the time it took the XT to perform the tests under the varying network load on each network. For comparison, we give the time it took to run the same tests



through the network with no other active stations (Zero stations).

The difference between the Network Speed Under Contention test and the Network plus Server Cruncher test lay in the size of the data blocks that the workstations moved over the network.

The Network Speed Under Contention test exercises the network when the network interface cards and the media are heavily loaded. We attempted to eliminate the factor of server disk access time from this test by loading the network with data blocks small enough to reside in the server's cache memory on most systems. In addition, we varied the size of the data files to detect any cache limits.

The Network plus Server Cruncher test heavily loads the network interface cards, the media, and

the server's disk drive access system. In this case we used data blocks of various sizes, some small, some large, when we loaded the network in order to exercise the hard disk drive access system. The results are influenced by hard disk performance and the efficiency of the networking software as it moves data on the disk and between the disk and the network interface cards.

During both of these tests, we used a hardware clock residing on an AST SixPak card in the XT to determine the starting and ending times. We did not use the system clock because its operation can be disturbed by some network functions.

The Smart series of integrated network programs from Innovative Software gave us a practical way to evaluate networks under the load of typical

applications. In fact, viewed on a system monitoring screen, such as NetWare's Net's, the Smart Applications benchmark test looks and acts like a busy office, because the level of activity varies between intense use of the network and quiet periods when processing takes place.

For the dependent variable plotted on the three-dimensional chart, we used an IBM PC-XT operating Innovative Software's Smart DBMS running a script file that indexed and sorted shared database records. The independent variable was one through four workstations running another script from Innovative Software that created bursts of activity interspersed with periods of silence.

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**CIRCLE 119 ON READER SERVICE CARD**

## ■ 3COM'S ETHERNET AND TOKEN-RING

neous use as both a server and a workstation is practical only on networks that are used very lightly.

**3+Share's** Name Service manages the names of the users and the servers on the network. Each user has a unique name, but you can also aggregate users into groups for special purposes. As an individual user in an office, you would have access to your own files under your user name, but you also might have access to certain accounting files as a member of a group named Keypunch in addition to access to certain inventory files as a member of a group named Shipping. When you sign on with your user name, the network operating system consults a table in order to determine your group membership.

This ability to form special-category groups for users is a typical feature of good networking software. This feature allows network administrators to permit or restrict individual actions efficiently without entering and changing the profile of each user one by one.

The name structure facilitates the job of linking networks by allowing three levels of name specification. These names might be, for example, the department, the work group, and the individual. The department name would probably refer to a particular file server on a network, while the work group and the individual names would be linked to specific directories and subdirectories.

The File Service manages shared directories on the network. When the network administrator adds a user name into the system, **3+Share** creates a directory for that user called a home directory. The home directory is that user's personal root directory on the network. It is the basis for all work that the user does with files and programs on the network.

Once the link between the user name and the home directory has been established, the user can create, read, and write files as if the directory were on a local disk drive instead of on the server's disk drive. Other network users can share the user's home directory and any subdirectories at the discretion of the owner of the home directory. The major shared directories on a 3Com system usually include applications programs, data files, electronic mail, and networking software files.

**SHARENAMES** 3Com uses a concept called "sharename" in an attempt to simplify DOS path statements. Normally, people on MS-DOS systems type in the command PATH and a series of file specifications to tell DOS how to link directories, such as those of DBMS applications, to other directories, such as those containing the data files the applications must sort. In **3+Share** a user or a network administrator creates a sharename to simplify the process.

Sharenames group subdirectories chosen by the user and are not necessarily the

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■ The home directory is the user's personal root directory on the network. It is the basis for all work that the user does with files and programs on the network.

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actual subdirectory name. The sharename PAYROLL can include detailed information about applications and data files the user wants to link to, so a person just signing onto the system merely types PAYROLL instead of entering all the data.

The sharename concept allows the network administrator to change the arrangement of the active directories and subdirectories while keeping the same sharename. In this way users do not have to change their log-on procedures if the files are rearranged. Since the actual subdirectory name is not used, an added layer of security is also created.

**3+Share's** Print Service manages the shared printers connected to a server on the network. Each PC-type server can have three printers attached (two parallel and one serial). Each printer is given a unique printer sharename. Users at workstations execute a command linking the printer sharename to one of their workstations' output devices such as LPT1 or LPT2.

When an applications program such as a word processing program directs an output to LPT1 of the workstation, the network intercepts that output and routes it to the named printer on the server.

When a server's printer is linked to a workstation's output device and an applications program sends characters out to be printed, those characters are sent through the network to the server, where a print queue is formed. Network administrators can change the priority of named users in the print queue so that, for example, work submitted by an executive secretary is always queued up for printing before work submitted by the accounts payable clerk.

The Dial-In Remote Service lets a remote user access the network almost as if the PC were directly connected to the cable. The limiting factor is the speed of the telephone line used to connect the PC to the network. If both the remote workstation and the server are equipped with modems operating at 2,400 bits per second or faster, the service is almost like being directly connected to the network. The use of slower modems results in a significant amount of time elapsing between a request being entered on the keyboard and a response appearing on the screen of the remote workstation.

**3+Share** allows inexperienced or infrequent users to make changes to the program through a series of menus. These menus are well illustrated and as good as any in the industry. But menus have limited usefulness in the LAN industry.

Systems are usually set up for all users through batch files, which the network administrator creates. Experienced network administrators can make temporary assignments and changes as quickly and simply as entering DOS commands.

**USING THE SOFTWARE** The commands used in **3+Share** were probably the template for the command structure used by IBM's *PC Local Area Network Program* and Fox Research's *10-NET*. This structure follows an easily understandable hierarchical format. The command

3F LINK Y: \\PCLABS\WPFILES

links the Y: drive on a network workstation to the WPFILES sharename on the server named PCLABS.

## ■ 3COM'S ETHERNET AND TOKEN-RING

In an operational network the average person using a workstation would never need to know how to issue a 3F LINK or similar command or how to use a menu. The network administrator would build these commands into batch files personalized for each person's applications. Anyone who wanted to become more independent of the network administrator would have to know a lot about DOS—menus or no menus. A network administrator with many dependent clients on an active 3Com network could spend a lot of time building and customizing batch files.

**LIMITATIONS AND MYSTERIES** One of the first things we saw during the installation of 3+Share in the workstations is that the network driver program code hides itself in RAM. A PC on a 3Com network loses 138K bytes of RAM to the combination of DOS 3.1 and 3+Share. Workstation users could be unpleasantly surprised to find that their spreadsheet won't load because the networking software has stolen some RAM.

Some other networking products, such as *NerWare*, do not increase RAM usage in the workstations. Perhaps adding 3Com networking software to their PCs will force organizations to expand the memory in the workstations attached to the networks.

We discovered an as-yet-unsolved mystery when we tried to run an application under the EtherLink card on one particular workstation in our PC Labs tested. One IBM PC with a recent serial number and current version of ROM BIOS signed onto the 3Com network without a problem, but it always stopped cold when asked to transfer a file. Three other identical machines on the network functioned perfectly. We swapped out every disk controller, memory card, I/O, and video card, but they made no difference. We can only guess that this particular machine had a quirk in its DMA controller that caused it to hang up under certain conditions. This situation proves that it is impossible to predict all the combinations of conflicts that can occur when you stretch a computer's resources by networking.

**OVERALL EVALUATIONS** Our benchmark-test results and subjective reports show that all three network card and server

combinations—TokenLink Plus on the 3Server3, EtherLink on the 3Server3, and EtherLink Plus with the AT as server—are capable of carrying heavy loads. The TokenLink Plus/3Server3 configuration, which enables every workstation to communicate during the busiest times, would be particularly effective in industrial process control and other busy and critical environments. EtherLink/3Server3 is more

### PC MAGAZINE EDITOR'S CHOICE

- Standard Microsystems Corp.'s ARCnet running under Novell's Advanced NetWare/286 on the 8-MHz IBM PC AT server
- 3Com Corp.'s Ethernet running under 3+Share on the 3Server3

*PC Magazine has reviewed many excellent local area network systems in this series. Until now our Editor's Choice has consistently gone to Novell's Advanced NetWare/286 running with Standard Microsystems Corp.'s ARCnet on an 8-MHz IBM PC AT for outstanding performance, security, and system flexibility. But now we must declare a tie for Editor's Choice: 3Com's Ethernet running under 3+Share on the 3Server3 has the performance and features to match the Novell/Standard Microsystems team, plus it has the added flexibility of the standardized Ethernet interface. This interface opens an even wider world of interconnection capabilities.*

efficiently for systems with short and unevenly spaced messages such as those in an office environment and in work groups. In some applications, the EtherLink/3Server3 configuration had response times as fast as any system we have tested.

Our benchmark tests show that the 3Com Token-Ring and the Ethernet system share the pinnacle of performance with only a few other networks. Novell's Advanced NetWare/286 teamed with Standard Microsystems Corp.'s ARCnet on the 8-MHz PC AT server has been our re-

sponse-time leader; Ethernet teamed with 3+Share the 3Server3 matched that combination in almost all tests.

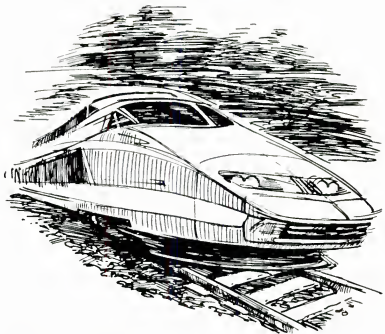
Our benchmark tests attempt to generate both long (4,096 bytes) and short (2-3 bytes) messages to send across the network. We used many more shorter messages than longer ones, since we believe they are more typical of most office and warehouse settings and of developmental applications. In this environment, Ethernet really moves data. 3Com Token-Ring is fast and steady, too, but Ethernet is a trifle faster in addition to probably being easier and less expensive to install.

Our comparison between the 3Server3 and the 8-MHz IBM PC AT as server was hardly fair. The 3Server3 was holding 3 megabytes of RAM and using every free byte to cache and buffer data. During the Network plus Server Cruncher benchmark test, the disk drive light on the 3Server3 seldom flickered despite the fact that the database we use is quite large. The AT was limited to 512K bytes of RAM, and the light on its hard disk drive glowed as it moved data. The AT took over 4 minutes to do the same tasks the 3Server3 did in slightly over 1 minute. The AT gave good response times, but electromechanical systems simply cannot outpace silicon.

Here is the bottom line, based on our evaluations of the 3Com products: If your application is industrial (using the MAP protocols), or if you need high-speed access to IBM mainframe systems through the IBM Token-Ring Network mainframe interfaces, consider the 3Com Token-Ring Network as a strong alternative to the IBM Token-Ring Network. Decide between the two products on the basis of the differences in the wiring plan and the dealer support that you can get.

If your application is for heavy office automation, on-line reservations, inventory, accounting, or other DBMS work, compare Ethernet with 3+Share on a 3Server3 to a system like Novell's Advanced NetWare/286 running on a fast 80286 microcomputer using the ARCnet network cards. Make your comparison based on cost, cabling differences, and dealer support. You won't go wrong. ☐

*Frank J. Derfler, Jr., is a contributing editor of PC Magazine.*



## How a French train inspired the fastest 286 micro you can buy.

Not just any French train, but "La Grande Vitesse"—"The High Speed." It's the fastest train in the world, routinely eating up steel tracks at speeds normally associated with small aircraft.

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### A power user's dream

The GV-286 is the first 80286 micro to include a high-speed RAM cache circuit, making data retrieval from the processor almost instantaneous. It's the same design feature that makes our new GV-386 the fastest machine in that sanitized category.

The cache circuit also assures high reliability, allowing the GV-286 to operate at super-high speeds without pushing its integrated circuits beyond their design limits. Other 12MHz machines put their ICs through hell to achieve high speed, and that means they're inherently less reliable.

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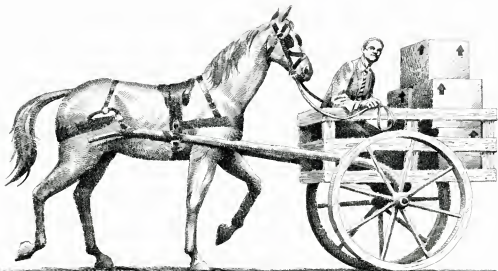
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# NETWARE UTILITIES

## FILL THE DUTY ROSTER



**N**ovell's *NetWare* LAN software, now considered a standard among the more than 20 companies selling it and some 300,000 workstation users using it, includes print spooler features. But while *NetWare* itself is widely heralded for its networking abilities, its print spooler remains the weak link. The most common complaints from users relate to the printer-spooling facility. While the *NetWare* spooler is quite powerful, it can be unwieldy to use. Many steps are involved in using it—including going in and out of your applications program—because you must initiate the spooler from the DOS prompt.

Four of the packages reviewed are utilities designed specifically to enhance *NetWare*'s spooling functions. But to give you a basis for comparison, I'll first tell you how the *NetWare* spooler works. Producing a document on a shared network printer under *NetWare* takes three steps.

First, you must tell *NetWare* that you want to redirect your output to the shared printer. This is done using the spool command at the DOS prompt.

Then, using your applications program, go ahead and print the document. *NetWare* will intercept the data stream from your program before it reaches your printer port and then "spool" this data to a disk file on the network file server.

Finally, you must tell *NetWare* that you are at the end of the document using the *endspool* command at the DOS prompt. That command closes the spool file. Depending on whether or not the printer is already outputting other data, your copy is either printed immediately or placed at the end of that printer's queue. Each job in the queue will be printed in turn.

The procedure is handled a bit differently in the newer versions of *NetWare*. In *Advanced NetWare*, Version 2.0 and later versions, Novell added a "timeout" feature to the spooler. That means if no data is sent to the printer in a few seconds, *NetWare* will automatically perform *endspool* and *spool* commands. While this so-

lution works just fine if you don't need to change printers, forms, or any of the other spool flags, it isn't perfect. For example, if you must change printers, you still must return to the DOS prompt. Another problem is that if you have a slow-running program that's calculating as it goes along, a long pause may cause *NetWare* to assume you're done. *NetWare* will then go on to the next printing job. The result: your slow program may be printed in fragments between other documents.

Some applications programs are made in Novell versions so that *spool*, *endspool*, and other function calls can be programmed into the application to work automatically. Products like the network version of *WordPerfect*, for example, can make the whole print-spooling process transparent while taking advantage of special printing functions in the applications program.

Unfortunately, most software doesn't come in special Novell versions. And the network versions of most applications software usually only have record- and file-locking functions (both are important to prevent a second user from accessing or processing a file or record while it is already in use) and don't support the spool-

---

*Novell's NetWare has proven to be an efficient worker for the more than 20 companies that sell the program with their local area networks. Now a set of specialized utilities improve its printer-sharing and network security operations.*

---

## ■ NETWORKING UTILITIES

er. This means that users often have to return to the DOS prompt in order to run the spool and endspool commands manually.

**WHAT TO WISH FOR** Before I go into the four spooler enhancement programs in detail, I'd like to interject my wish list for the perfect spooler enhancer.

1. The perfect spooler enhancer would be a memory-resident program taking up very little of the user's precious memory. After all, *NerWare* takes 40K bytes by itself.

2. Like any good memory-resident program, it should work with other memory-resident software such as *SideKick* and *SuperKey*.

3. The "hot key" that initiates the program functions should be user selectable; for example, many of the current programs use key combinations already prevalent on leading programs and thus are confusing.

4. The user interface should be simple, with pull-down or pop-up menus. Such menus would allow you to choose a specific printer that has a special font and/or that

■ *PS-Option* meets my wish list criterion of simple use. You need only move the highlight bar to the function you want and press Return.

handles certain forms. The menus would simply list the printers available on your system as well as the fonts for the printer you selected. These lists should use terminology anyone can understand, like "Laserjet in Accounting" or "Daisy wheel in Bob's office" (printers on other servers should have the same type of designations). And once you've chosen the printer and font, you should be able to set the spooler flags for parameters like the number of copies, whether to eject a page at the end of the job, whether you want a banner, and what the banner text should

be. (A banner is a page that serves to separate print jobs. It usually lists the user's and applications program's names.)

5. The spooler enhancer should set the printer back to its default settings after your job is printed, so other users won't get stuck with your fonts.

6. Finally, I'd like to see the spooler enhancer print graphic screen dumps (as does the *ProSpool* product detailed below) to a designated printer.

I've arranged the following reviews of spooler enhancers in order from the easiest to use to the most complex.

### PS-Option

Weston Associates' *PS-Option* enhances *NerWare* functions minimally and, thus, misses many of my wish list criteria. It has only the basic features such as spool, endspool, and the ability to change a couple of flags; it also takes up 22K bytes of memory—more than most other products mentioned in this article. Its only real saving grace is that it is the least expensive of the products tested.

*PS-Option* is invoked by pressing the Shift-PrtSc key, which in turn brings up the menu. This hot-key combination is the same as that used in DOS to dump a screen. Unfortunately, you can't change the keys in *PS-Option*, so this potentially confusing situation can't be remedied.

Since *PS-Option* has usurped the DOS print screen function with its Shift-PrtSc hot key, you can issue a print screen directly from its menu. But unfortunately, the result of this ease-of-use feature is a problem: it's the equivalent of a spool-print screen-endspool sequence, and it will interrupt any print job being run and start a new one.

However, the utility meets my wish list criterion of simple use. You need only move the highlight bar to the function you want and press Return. Options available to you are: Start Spooling, End the Current Spool, Nprint a File, Print the Screen, Exit, and Help.

If you select any of the options that create a print job (Spool, Print Screen, or Nprint a File), *PS-Option* will allow you to set the most commonly modified spooler flags, such as which printer to be used, the number of copies, the type of form for out-



## FACT FILE

### PSoption

#### PS-Option

Weston Associates Inc.  
140 Marble Dale Rd.  
Eastchester, NY 10707  
(914) 779-4773

List Price: \$49

Requires: 22K RAM;  
one disk drive to load it

on network; DOS 2.0 or later; Novell  
*NerWare*.

In Short: A low-cost but limited spooler enhancer. Not copy protected.

CIRCLE 841 ON READER SERVICE CARD

put, whether to print a banner, and whether to expand tabs. If you do want to expand tabs, you can choose the number of spaces.

*PS-Option* does not allow you to select the banner text, suppress the default end-of-job page eject, or keep the print job file after printing (instead of deleting it). *PS-Option* supports only a single file server and does not have any font change features.

However, while *PS-Option* supplies the most commonly needed functions in an easy-to-use package, other spooler enhancers give you all the same features and more, while using less memory. Again, its only redeeming value is its bargain low price of \$49.

### Network Assistant

In addition to closely meeting my ideal print spooler criteria, Pacific Software's *Network Assistant* is the friendliest among this group of spooler enhancers. I consider its user interface top-notch. Like *PS-Option*, all of its features can be selected by moving highlight bar menus. But unlike *PS-Option* and most other programs of its kind, there is no need to keep track of printer and font numbers or other obscure information.

*Network Assistant* does have the same flaw as *PS-Option* in that the Shift-PrtSc keys pop up its menu, although it minimizes the flaw by giving you the ability to change the hot key to some unused sequence. You can select a printer from a list of names like "Laserjet in Bill's office" or

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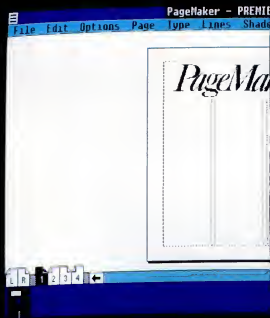
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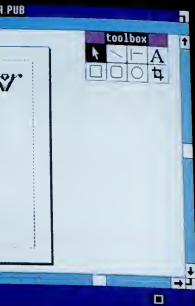
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## ■ NETWORKING UTILITIES

"plotter in engineering" rather than picking a number for a printer.

Printer fonts can also be selected by name. *Network Assistant* keeps separate font code files for each printer defined. After you select a printer, you select your font from a list for that printer. *Network Assistant* will even let you set fonts on your local printer. Your firm's network administrator can define as many as seven printers per workstation and can restrict access to certain shared printers when setting up the *Network Assistant* program. The administrator can also define as many as 12 fonts per local printer. Each font can have up to 12 bytes per code, and these codes are additive. This means that if you want bold and compressed print, you can select bold-face and then compressed without having to define a bold and compressed font. The only other criteria *Network Assistant* lets you set are the tab expansion, number of copies, and banner spooler flags.

When you have finished printing, *Network Assistant* will automatically reset the printer to its default settings.

Besides offering the spooler enhancer features, *Network Assistant* lets you send messages to other stations without leaving your application. It also lets you undelete files, an important feature for *NetWare* users since the usual tools for undeleting files, such as *The Norton Utilities*, will not work on network disk drives.

Another feature I like is a "remove pro-

gram from memory" selection on its menu, thus reclaiming the 25K bytes it consumes. Getting these bytes back can make a big difference in fitting a large spreadsheet into memory, for example.

Although *Network Assistant* is not copy protected per se, it must be serialized to

■ *Network Assistant* comes close to being the ideal spooler enhancer. I recommend it to anyone who doesn't need to print on multiple servers or use long printer codes.

your server. It will then work only on that server. The serial number is kept on a board that can be swapped to another server, should you need to repair or replace yours. The *NetWare* software itself, as you will recall, is similarly serialized.

*Network Assistant* comes very close to being the ideal spooler enhancer. I strongly recommend it to anyone who doesn't need to print on multiple servers or use long printer codes.

The company has announced new features for the version to be released in February 1987; these include the ability to use multiple servers, view and prioritize jobs in the queue, and preset default spool flags.

### Pro-Spool Plus

APS Research's *Pro-Spool Plus* has almost every feature you could want in a spooler enhancer, and for basic use it takes only 11K bytes of memory—the least of any product tested. While its user interface is not as nice as *Network Assistant*'s, it does have a graphics screen dump option and supports multiple servers. *Network Assistant* can't do either.

Besides including the basic spool functions, *Pro-Spool Plus* lets you build a file

of printer font initialization codes. The codes can then be selected from the menu when you are printing. The code file, called a printer action table, holds as many as 99 font strings as large as 255 bytes each. The problem is that the fonts are not segregated by printer, so you can accidentally select the code for an Okidata when you're printing on an Epson, and your printout will be unreadable.

Unlike the other products mentioned so far, *Pro-Spool Plus* does allow you to produce documents on printers attached to alternate network servers. On a large network, you will often need to print on another server's printer, either to expedite printing, use a specific type of printer, or even send output to a plotter. *NetWare* supports only five shared printers per server but an unlimited number of servers.

*Pro-Spool Plus*'s menu is invoked with an Alt-Z hot key. Alt-V will let you spool, print screen, endspool, and spool again automatically. Alt-N will close the current job and begin a new one without going to the main menu or DOS prompt. The Alt-N command is quite handy, since it is the most frequently used function on any spooler enhancer. These hot keys can be changed when you install *Pro-Spool Plus*, but the choices are limited to Alt-A through Alt-Z.

While *Pro-Spool Plus* is the only program among those listed here with a graphics mode that will dump graphics screens from a color/graphics adapter to an Epson-style printer when you print the screen, that option requires that you have an addi-



## FACT FILE

*Network Assistant*  
PC version (see page 10)

Ever's Guide  
Nov 1986

### *Network Assistant*

Pacific Software  
2033 N. Main St.  
Walnut Creek, CA  
94596  
(415) 977-4040

List Price: \$125 per file server

**Requires:** 25K RAM; one disk drive to load it on network; DOS 2.0 or later; Novell *NetWare*.

**In Short:** A *NetWare* spooler enhancer with a very good and friendly user interface. It must be serialized to network and has good font control. Not copy protected, but serialized to a specific server.

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## FACT FILE

APS  
*Pro-Spool Plus*  
POP TOP ENTRY

### *Pro-Spool Plus*

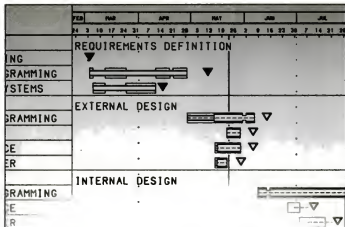
APS Research  
1062 W. Taylor  
Chicago, IL 60607  
(312) 666-3352

List Price: \$119.95 per file server

**Requires:** 10K RAM; one disk drive to load it on network; DOS 2.1 or later; Novell *NetWare*.

**In Short:** A powerful spooler enhancer including a graphic screen dump function. Not copy protected.

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## ■ NETWORKING UTILITIES

tional 11K bytes of memory for the printer codes and yet another 16K bytes to add graphics.

I'd recommend *Pro-Spool Plus* for multiple LANs including multiple servers. It is my second choice for a print spooler enhancer.

## Hot Print

*Hot Print*, from Ron Turley Computer Associates, is a programmer's idea of the perfect spooler enhancer. Each feature has its own hot key, so you never have to bother with going through menus. *Hot Print* has 58 different hot keys and uses Ctrl-Alt combinations heavily. These hot keys cannot be changed and are likely to conflict with those of most other programs because of the sheer number of key combinations. Printers, servers, and fonts are referenced only by number, and there is a serious dearth of help features. However, Alt-Left Shift-V does display a small menu on the bottom two lines that lets you set the spooler flags using the arrow keys, and Alt-Left Shift-H shows the same menu along with a full-screen display of all the *Hot Print* functions.

Other utilities offered with *Hot Print* include a program that appends a message to a supervisor file, thus creating a basic audit trail with time, date, and user stamping. It also has a utility that locks a .COM or .EXE file and sets a special *NetWare* flag to make it an execute-only file. Execute-only files cannot be copied, so the feature serves to dash the most zealous attempts of



## FACT FILE



**Hot Print**  
Ron Turley Computer  
Associates  
1642 W. Sequoia  
Phoenix, AZ 85027  
(602) 581-2447  
List Price: \$99

**Requires:** 128K RAM;  
one disk drive to load it on network; DOS 1.0  
or later; Novell NetWare.

**In Short:** A spooler enhancer plus administrator's utilities that uses many hot keys. Not copy protected.

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## ■ NETWORKING UTILITIES

would-be software pirates. Several of the utilities make the administrator's job much easier by doing such tasks as listing all the users and groups on the server and forcing users to get into the habit of changing their passwords periodically.

One nice feature of *Hot Print* is a timeout function similar to that of *NetWare*, Version 2.0, for users of earlier *NetWare* versions. This timeout will close a print job and open a new one if there is no printer output in a user-specified period. If you use *NetWare* 2.0, *Hot Print* lets you disable its timeout so that you can use computer-aided design, desktop publishing, and other programs that may have delays in the middle of a print job.

■ *Hot Print* supports the Lotus/Intel/Microsoft expanded memory specification, reducing the amount of main memory required to run it.

*Hot Print* also transparently supports printing on multiple file servers. A setup utility, *HPSET*, lets you assign logical printer numbers to printers on multiple servers. As many as five printer initialization codes and one printer reset code can be set for each of the first three printers. Each of these codes can contain up to 10 bytes—much too small for the 17 bytes required by an HP Laserjet. *Hot Print* can also automatically reset the printer to its default settings after each print job.

*Hot Print* supports the Lotus/Intel/Microsoft expanded memory specification, reducing the amount of main memory required to run it (12K bytes). This is a difficult feature to implement, and *Hot Print* is the only one of these print spooler enhancers to have it.

Although *Hot Print* is a powerful spooler enhancer, it is rather difficult to use. I wouldn't recommend it for nontechnical personnel.

## Other Utilities

There are other utilities that improve the *NetWare* program, such as the following ones enhancing network security, and even one that creates *NetWare*'s first print server. Some of the products have multiple functions. I'll run through each, describing the pros and cons.

## NET Utilities

*NET Utilities*, from Network Enhancement Tools, includes an audit-trail program as one of its 15 different programs. A pair of utilities, *NETLOG* and *PREPLOG*, can produce a basic audit trail of application usage. *NETLOG* will append a record to a special supervisor file each time it is run. These records include the date and time, user name, workstation, and command-line parameter. *PREPLOG* sorts the data in the file and then converts it into a comma-delimited file that can be read by most database managers.

Even though *NET Utilities* is not sold primarily as a spooler enhancer, it does include the *PrintTamer* utility, which is about as good as *Pro-Spool Plus* and has the most powerful printer- and font-control system of any I tested. It is the only prod-

uct that can download soft fonts to laser printers—a nice extra feature even though the downloading process is slow. *PrintTamer* can use an unlimited number of printer definition files (PDFs) for different printers. You create a PDF with up to nine

■ *NET Utilities* has the most powerful printer- and font-control system of any tested. It is the only program that can download soft fonts to laser printers.

initialization codes of 70 bytes each from your regular text editor. Each font can have its own deinitialization (font-end) code, which reduces the number of pages ejected from the printer (otherwise the printer could eject several sheets of paper after it is reset). The product includes sample PDFs for Epson, HP Laserjet, and Toshiba printers.

The utilities *ID* and *WHOIS* are used by the network administrator to maintain the network's electronic mail system. When a user name is added to a *NetWare* system, the utilities create a directory for the user with a name corresponding to the user number. Unfortunately, when the user name is deleted, the mail directory often remains because it is not automatically deleted. *ID* shows the user number when a user name is typed into the computer, and *WHOIS* shows the name assigned to a user number.

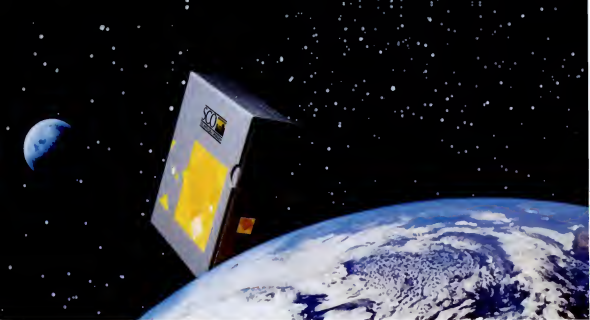
*NetWare*'s electronic mail system does not afford any simple way to print mail. However, *NET Utilities* includes a *PrintMail* utility that allows you to print and delete mail sent to you and mail that you have sent. The *CheckMail* utility will check your mailbox for messages without loading the whole electronic mail system.

*NET Utilities* lets you build a menu system that can include log-in and log-out

**FACT FILE**

**NET Utilities**  
Network Enhancement Tools  
P.O. Box 271105  
Houston, TX 77277-1105  
(713) 240-6614  
List Price: \$195 per file

server  
**Requires:** 49K RAM; one disk drive to load it on network; DOS 2.0 or later; Novell *NetWare*.  
**In Short:** A complete package of utilities for *NetWare* including spooler enhancer, menu system, and administrator's tools. Not copy protected.  
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## ■ NETWORKING UTILITIES

functions—a real timesaver. Menus have eight selections, each with an additional eight subsections. You can protect each of the eight main or subsections with an individual password. While not as pretty

as the menus created with the *NetWare 2.0* menu utility, these menus are fully functional and quite quick. Netmenu also has a blank-screen feature to save your monitor's phosphors.

Another utility, *OnCall*, lets you send short messages to other users. These messages appear on the 25th line of their display as if they were sent with the *NetWare SEND* utility. *OnCall* can be installed as a memory-resident program, allowing you to send messages without leaving your application. This could be useful, for example, if you need to install special forms on a printer on the other side of the office and want someone else to do it. *OnCall* will let you send a message to as many users as you want. It also shows you whether they

---

■ **NET Utilities' OnCall** utility can be installed as a memory-resident program, allowing you to send messages without leaving your application.

---



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have received the message. The hot keys for both *OnCall* and *Printamer* colors can be changed.

*NET Utilities* offers a wide range of functions for *NetWare* users, some of which cannot be found elsewhere.

As local area networks proliferate, more and more confidential data is being stored on network file servers. While *NetWare's* security system does control user access to data quite well, it does not create a record of file accesses or user log-ins and log-outs.

While *NET Utilities* and the previously mentioned *Hot Print* both take advantage of a *NetWare* function call that logs a message to a special file into the *SYS:SYSTEM* directory, they are quite limited in their ability to create a useful audit trail. These utilities must be run from the DOS prompt, and the best a network administrator can do is build menus that execute the utility before and after each application. This will create a trail indicating that a given user ran 1-2-3 from 1:50 P.M. to 2:45 P.M., but it won't tell which files were used.

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## ■ NETWORKING UTILITIES

### LAN Tight

LAN Tight from Blue Lance has a more complete audit-trail system than *NET Utilities*. All user log-ins, log-outs, and all file accesses can be logged into data files for bill-back accounting or for general system control.

The program does, however, have several major deficiencies: it can't track unsuccessful log-in attempts or indicate whether users leave their machines without logging off, and it can't track users on multiple server systems. To make matters worse, the records are stored in such a way that a smart, successful hacker could destroy all the records.

LAN Tight is memory resident, so it can automatically create log files and an administrator's utility for generating reports. The memory-resident module should be loaded as part of each user's SETLOGIN script. It consumes about 10K bytes of memory. The administrator's module has a user interface very similar to *NetWare*'s menu-based utilities, such as MYCON. Using LAN Tight, the administrator can select which user, files, or directories to track.

Log-ins and log-outs are stored separately from file access records. Each file is limited in size to 1 megabyte, so the system administrator must remember to purge the files to make sure they don't fill up, because LAN Tight will stop writing information to a filled file.



### FACT FILE

LAN Tight  
Version 1.0  
Program Description  
User 11 Files

LAN Tight  
Blue Lance  
P.O. Box 430546  
Houston, TX 77243  
(713) 680-1187  
List Price: \$495 per file  
Requires: 10.2K RAM;

one disk drive to load it on network; DOS 2.0 or later; Novell *NetWare*.

**In Short:** An audit-trail package for *NetWare* that keeps track of log-ins, log-outs, and file usage. For single-server systems only. Not copy protected, but serialized to a specific server.

CIRCLE 642 ON READER SERVICE CARD

At last! - Fast, On-screen

# FLOWCHARTS

While *LAN Tight* is a major step in making LAN security control more like the audit trails prevalent in minicomputers, it is lacking in several areas. Besides the deficiencies already mentioned, *LAN Tight* currently supports only one server. Although it is a good start as an audit-trail package, I'd still recommend *LAN Trail*—a description of which follows.

## LAN Trail

*LAN Trail* from LAN Services has all the security control of *LAN Tight*, but without such obvious deficiencies. *LAN Trail* can keep users from logging in without first loading the *LAN Trail* program. It can limit the number of users that can be logged in under the same user name as well as track unsuccessful log-in attempts, including the station where the attempt occurred.

*LAN Trail* uses the supervisor's message file and a special *NetWare* function call for creating log files to build its audit trail. This feature prevents unauthorized users from erasing records of their own break-ins, which is something they can do on *LAN Tight*. Another improvement over *LAN Tight* is in the way bill-backs are handled when a user doesn't log off. When that happens, *LAN Tight* won't provide a log-off time on its report, making bill-back by connect hour difficult, if not impossible. However, *LAN Trail* uses the last access time as the log-off time, giving you a log-out time accurate to within about 2 minutes. In my experience, users actually

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HP 7475A (& compatible) plotters. Can be used with ANY printer when non-graphic (character) output is acceptable

• All standard flowcharting shapes included • Most shapes supplied in large, medium and small sizes • Extensive manual (100+ pages) includes many examples • Context sensitive "help" facility provides immediate assistance at any time • Any number of titles can be placed on a chart • Commentary text blocks can be placed anywhere in the chart • Fast: written in assembly language • Plus many more features than we can mention here

Requires at least 320K memory, DOS-2 or higher and an IBM or Hercules compatible graphics card. On EGA, full 640x350 resolution is used.

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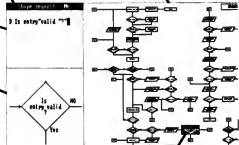
The sample screen display shown below is typical of what you see while editing a chart. Other screen displays are provided for entering titles, changing options, getting "help" and so on.

**STATUS BAR** (not to be confused with a wet bar) tells you what *Interactive EasyFlow* is doing at all times.

**TEXT/MESSAGE WINDOW** used to enter user text and to display messages from *Interactive EasyFlow*.

**CURRENT SHAPE WINDOW** - shows the content of the current flowchart shape (the one under the **SHAPE CURSOR**) in complete detail.

**CHART WINDOW** gives an overview of your chart: this example shows the "normal" view. "Close-up" view shows a smaller part of the chart in more detail. "Wide-angle" view shows a larger part of the chart at reduced size.



**SHAPE CURSOR** shows where you are in the chart. Cursor keys move it around; chart window scrolls if you run off the edge of the window.

## PC FACT FILE

### LAN Trail

**LAN Trail**  
LAN Services  
19 Rector St.  
New York, NY 10006  
(212) 797-3800

List Price: \$595 per file server

Requires: 3K RAM; one disk drive to load it on network; DOS 3.2; Novell Advanced NetWare.

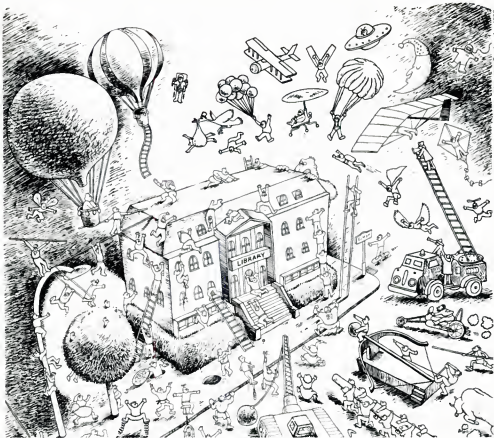
**In Short:** A powerful audit-trail system that tracks unauthorized log-ins, file access, etc., and works on multi-server systems. Not copy protected.

CIRCLE 807 ON READER SERVICE CARD

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## ■ NETWORKING UTILITIES

a hole in your system security.

*PS-Server* converts a workstation into a dedicated print server for as many as three printers. Since users needn't use the file server console to control print queues, they

don't have to walk over to the server or have physical access to it—an added security precaution. The utility program also lets you have multiple printers taking data from the same queue, allowing you to print

certain information on specific forms or have the printers access a busy queue to reduce the wait for a printout. In addition, *PS-Server* lets you expand the five-printer limit inherent with *NetWare* if you have *PS-Server* access the same queue as a printer attached to the network file server.

*PS-Server* gives you full control of the print streams for each printer so that you can stop and then restart print from the beginning. You can also cancel a job, view the print queue, Nprint a file, and change the priority of a job. The server will keep track of the form type installed on each printer and will display a message if the next job requires a different form. You can also prepare a batch of jobs based on the form type, so all the jobs for invoices can be printed at the end of the day or week. You can even give priority to different jobs so a user can force an important report to the beginning of the queue.

*PS-Server* adds great flexibility to *NetWare*'s printing system. Combined with *Network Assistant* or even Westcon's own *PS-Option*, it can give you complete control over all your printer output. It does seem rather excessive, however, to have to dedicate a PC to run three printers. I would like to see *PS-Server*'s features in a non-dedicated version that allows you to continue to use the PC as a workstation. *PS-Server*'s requirement of a supervisor-level user to run it is also a security risk. Anyone familiar with *PS-Server* who knows you are using this product also has a valid account

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## FACT FILE

### PS-Server

Westcon Associates Inc.  
140 Marble Dale Rd.  
Eastchester, NY 10707  
(914) 779-4773  
List Price: \$695; \$595  
(for six servers on one local area network).

**Requires:** 256K RAM; one disk drive to load it on network; DOS 3.1 or later; Novell Advanced NetWare.

**In Short:** A dedicated printer server for Novell NetWare that allows sharing of printers connected to a PC running it. Not copy protected.

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CIRCLE 636 ON READER SERVICE CARD

ple, there are menu choices for database and DOS functions, you could type DA for database or DO for DOS functions, inputting just enough characters to pull up that unique word.

*LAN Shell* provides a great deal of control over the appearance of menus. For instance, you can define both foreground and background colors and textures. I strongly recommend it for network administrators who need to create menus for their users. It's better than most other packages on the market today.

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*Howard Marks is a free-lance writer and the president of Networks Are My Life!, a New Jersey-based networking consulting firm.*

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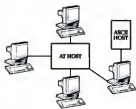


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CIRCLE 197 ON READER SERVICE CARD

■ PC LAB NOTES: DOS ENVIRONMENT ■ RICHARD HALE SHAW

# EXPANDING THE DOS ENVIRONMENT

*This second and concluding installment explains the limits of program interaction with the environment and the various ways by which you can expand its size.*

In the first part of this tutorial, I discussed the environment in general, the standard variables (PATH, PROMPT, COMSPEC) and the SET command, and how batch files can access the Master Environment Block directly. You'll recall, however, that when a batch file is run from a secondary command processor (to allow batch file nesting), changes can be made only to a copy of the environment and so are lost when the batch program terminates. This is a good point at which to take up the way applications programs access the DOS environment.

## PROGRAM AND ENVIRONMENT

Unlike batch files, which can access the Master Environment Block directly, programs (including memory-resident programs) get only a copy of the environment, either from DOS or from the program that loaded them.

Many popular applications programs have commands or options to load a second copy of COMMAND.COM without getting out of the program. The *dBASE III* RUN command, the BASIC SHELL command, and the *1-2-3* /S command are all examples of an applications program loading another copy of the DOS command processor. Any changes made to the environment in this way are made to a copy of the environment that DOS provides. These changes are lost as soon as you enter the EXIT command to return to the applications program.

All programs have two important memory structures that are provided by DOS: a Program Segment Prefix and a Memory

Control Block. The Program Segment Prefix (PSP) provides a program with information like command-line arguments, file-handling data, and the location of the next instruction to execute when the program terminates. The Memory Control Block (MCB) is set by DOS to mark off different parts of memory—specifically the memory allocated to a program (see the sidebars "A Closer Look at the Environment—a DOS Memory Map" and "Using DEBUG on the Environment").

These memory structures lie directly above a program's copy of the environ-

ment. If either one is accidentally altered by a program that is trying to make changes to its copy of the environment, some very serious errors could occur, including damage to data files.

The implications of this are worth emphasizing. Your program can read the copy of its environment, but it has to be careful about making changes. Changes will be available to any programs loaded by your program but will be lost when your program terminates. If the changes don't fit exactly into the space allocated to your program's copy of the environment, you face the probable disaster of overwriting a critical portion of memory.

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## MEMORY-RESIDENT PROGRAMS

Like other programs, the environment block used by a memory-resident program is a copy of the Master Environment Block, made by DOS when the memory-resident program is loaded. Since this copy is never updated, a memory-resident program will never see changes made to the Master Environment Block at a later time.

This has immediate implications. If a memory-resident program needs to refer to an environment variable to operate properly, that variable should be set before the memory-resident program is loaded.

Furthermore, every memory-resident program gets a complete copy of the environment, so the use of several memory-resident programs will eat up additional memory. This may be important if you have a large environment defined.

Finally, there is a somewhat puzzling warning in the DOS manual to the effect

## ■ PC LAB NOTES

that DOS cannot expand the environment beyond 127 bytes if you have loaded a memory-resident program, such as *MODE* or *SideKick*. The implication seems (to me, at least) to be that if you intend to expand the environment you would need not only to reserve a larger size (as explained below), but actually to fill that memory space with temporary bogus strings before your *AUTOEXEC.BAT* encounters its first memory-resident com-

■ Unlike batch files, memory-resident programs get only a copy of the environment.

mand. If this is indeed what Microsoft means, then they're simply wrong. Using the techniques below, you can safely expand your environment space without regard to TSR programs in or out of your *AUTOEXEC.BAT*.

### EXPANDING THE ENVIRONMENT

Creating useful utilities and batch files that make use of the environment won't do you much good if you don't have enough space to add new variables and information. The DOS default limit on environment space is 160 bytes, of which the *PATH* and *COMSPEC* variables take up a minimum of 29 bytes. Since this limit can become prohibitive rather quickly, you may want to take steps to expand it. The specific steps to take, however, will depend on your version of DOS.

DOS did not offer environment capabilities prior to Version 2.0. Since then, the default environment block size has been set at 160 characters. DOS sets the environment size in units of 16 bytes each (a "paragraph" of memory), and ten paragraphs (160 bytes) are allocated for the environment.

**USING DOS 3.2** The simplest way to increase the size of the environment above 160 bytes is to use DOS Version 3.2. Under DOS 3.2 you can set the initial envi-

## LOCATING THE ENVIRONMENT: A DOS MEMORY MAP

It may be useful in understanding the environment to see its place in the overall memory picture. As you look at the memory map shown in Figure A, you will see that a program's copy of the environment is always located below the program, its Program Segment Prefix (PSP), and its Memory Control Block (MCB). Thus the space provided for the copy is limited: only a few bytes higher in memory are areas that are vital to the program. Changes made to a copy of the environment must fit in that space.

To find a program's copy of the environment, you need to look into the PSP—the Program Segment Prefix. This is an area that DOS sets up with information for each program. All programs are

allocated one or more *segments* for their code. (A segment is a 64K memory block. Allocation by segments is a feature of the architecture of the Intel 8088 family of microprocessors). The actual code for a program begins at offset 100h in its first segment. The area from 0 to 100h is reserved for the PSP.

Among the many important items of information stored in the PSP is the memory segment address of the program's copy of the environment. This is stored at offset 2Ch in the PSP. You can use the DOS utility *DEBUG* both to find the address of a program's environment copy and to display the actual environment copy in memory.

—Richard Hale Shaw



Figure A: A DOS memory map highlighting the relationship between the environment and other areas in the memory hierarchy.

ronment allocation as large as 32K of memory! All you have to do is put a line in your system's configuration file, *CONFIG.SYS*:

```
SHELL=COMMAND.COM /S:XXXX /P
```

where the *XXXX* represents the size, in

bytes, of the Master Environment Block you want to reserve (a number from 160 to 32768) and */P* means "load *AUTOEXEC.BAT* automatically." It's important to note that if you omit the */P* here, *AUTOEXEC.BAT* will not be loaded even if it is present.

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# DEBUG AND THE ENVIRONMENT

To see the contents of your DOS environment, load DEBUG and, at its hyphen (-) prompt, enter

D2C 2D

DEBUG will display something similar to this:

```
-D2C 2D
3766:0020      8B 34      .4
```

When you loaded DEBUG, DOS made a copy of the environment available to it and placed the segment address of the copy at offset 2Ch in DEBUG's PSP (Program Segment Prefix). Segment addresses like this occupy two bytes of memory, and are stored in "reverse-byte" format. You simply reverse the bytes again to get a meaningful segment address.

The command you typed instructed DEBUG to display the contents of memory at offsets 2Ch through 2Dh (only 2 bytes). In the example above, the contents are 0Bh and 34h. Reversed to make a segment address, they become 340Bh.

Now, to get DEBUG to display the contents of memory at segment 340Bh, at the prompt enter

D340B:0

The "0" tells DEBUG to treat this as a segment address, starting at offset 0 in the segment. If you have a large environment initialized, you may have to enter several times to page through all of the environment copy. (You don't have to give the addresses for these sequential screen dumps.) The DEBUG display will look something like Figure B.

Looking at the ASCII part of the DE-

BUG display (on the right in Figure B), note that each environment string is stored as a series of characters terminated by a Null, or Zero byte. (The Null byte of the first string, COMSPEC, is on the second line of the center display, at 340B:0016). This is called an ASCII string. When you use SET to modify the environment, the internal DOS procedures invoked by SET supply this terminating byte automatically.

Each one of the series of strings in the environment is similarly terminated by a Null, to the end of the last string (PROMPT), which is followed by an additional Null byte. The two Null bytes together mark the end of the environment.

Some DOS documentation claims that the two bytes immediately after the end of the environment strings are a wordcount of the size of the environment. This would refer to the number of 16-bit words (2-byte pairs) that occupy this space. However, no matter how many times or how many different ways I loaded different size environments under DOS 2.0-3.2, this value steadfastly remained 01 00. So, if it's intended as a word count, it's wrong.

At the end, DOS places a copy of the complete file specification (drive, path, filename, and extension) of the current program. This is the string "C:\DEBUG.COM" shown at 340B:0056, followed by a Null terminator. (The address you get will, of course, differ from that shown in Figure B.) The remainder is garbage left over in memory from a previous program process.

To end your DEBUG session, just enter q, for quit.—Richard Hale Shaw

```
-D340B:0
340B:0000  43 4F 4D 53 58 45 43 3D-43 3A 5C 43 4F 4D 4D 41
340B:0010  4E 44 2E 43 4F 4D 00 5F-61 54 4B 3D 42 3A 5C 3B
340B:0020  44 3A 5C 3B 43 3A 5C 3B-43 3A 5C 42 49 4E 00 4F
340B:0030  4F 4D 45 44 49 52 3D 63-3A 5C 64 73 5C 62 72 5C
340B:0040  6E 65 70 74 62 72 00 5B-52 4F 4D 54 3D 24 78
340B:0050  24 5F 00 00 01 43 3A-5C 44 45 42 55 47 2E 43
340B:0060  4F 4D 00 43 4D 58 3D 64-3A 5C 63 3F 3B 2E 65 78
340B:0070  5A 13 34 2D 6D 3D 64-3A 5C 61 73 6D 3B 2E 65
```

```
COMSPEC=C:\COMMA
ND.COM.PATH=B:\J
D:\C:\C:\C\BIN.B
GHEDEH=C:\Win\N\
netbe, PROMPT=
S...C:\DEBUG.C
ON.CHF=d:\c\B\ex
S.d.k=d:\samd.e
```

Figure B: A DEBUG display of its copy of the DOS environment.







## ■ PC LAB NOTES

## ACCESSING THE ENVIRONMENT FROM C AND ASSEMBLER

The two programs READENV.EXE, whose source code is shown in Figure C, and READENV.COM, whose ASM listing is contained in Figure D, demonstrate how to read the environment strings and search for specific variables in the environment. READENV.C (Figure C), which becomes READENV.EXE, can be compiled with either the DeSmet C Version 2.51 compiler or Microsoft's Version 4.0 C compiler (MSC). READENV.ASM (Figure D) requires using MASM to produce READENV.COM. These programs and listings are available from the PC Magazine Interactive Reader Service, as explained in the sidebar "Downloadable Lab Notes."

These programs should be of interest to novice and veteran programmers alike. Both programs print the current environment strings in the same manner as the DOS SET command, and then find the current PATH variable and print the entire PATH string. Because the programs are written in a highly structured style, it's relatively easy to include their subroutines in other programs for reading and searching the environment strings.

*[Since the actual information returned by READENV can be obtained by entering SET at the DOS prompt, the interest in READENV.C and READENV.ASM is principally in the programming techniques employed and in the equivalences between a C and an assembler approach. For this reason we have set them in facing columns, but have not included the usual BASIC listing that would re-create READENV.COM.—Ed.]*

**ABOUT MICROSOFT C** Veteran C programmers are probably saying, "Microsoft C already has functions to read and search the environment." That's true, because since the release of MSC 3.0, you can use the function GETVAR() to retrieve environment variables and the function PUTVAR() to add environment variables. However, the MSC functions

do not access a program's copy of the environment itself, but a copy of the copy. Let me explain.

When you run a program written with Microsoft C, some of the MSC start-up code copies each of the environment strings from the copy provided by DOS to the local data segment. Then you can use GETVAR() to retrieve environment variables. But you can also use PUTVAR() to add variables and strings to the environment. This has to be the case because it's impossible to add new strings to a program's copy of the environment provided by DOS without deleting strings to free some environment space first (see the sidebar "A Closer Look at the Environment—a DOS Memory Map").

So PUTVAR() just adds strings to the local copy of the program's copy, where it is relatively free to monkey around with memory. If your MSC program loads another program, MSC will even tell DOS to use your local environment string copy instead of the program's copy. In this way you can add environment strings from one program that will be available to any other program the first one loads. But once your program exits, your changes will be lost.

So, for those who program in assembler or in C, these programs will probably be of interest.

**READENV.C AND READENV.ASM** The key element in both these programs is a subroutine called FIND\_ENV\_STRING(). It will

1. get the segment address of a program's copy of the environment;
2. copy the first environment string found to a local buffer area;
3. on subsequent calls, copy the next environment string found until it finds the end of the environment.

In the C version, FIND\_ENV\_STRING() requires you to pass a parameter to it to tell it whether to search from the beginning of the environment or from

its last search position. The assembler version does this by setting a value into a variable. Both versions make use of a buffer area called ENV\_STR\_BUFFER, which is long enough to hold an environment string and its Null (Zero-terminating) byte.

By calling FIND\_ENV\_STRING() in a loop you can examine each individual environment string and do what you wish with it. This is demonstrated by the subroutine called SET(), which mimics the DOS SET command.

You can also use FIND\_ENV\_STRING() to retrieve a string and scan it for a particular variable. Suppose you wrote a program that needed to search the DOS PATH for a file. By calling the subroutine GETVAR() presented here, your program could retrieve and examine the whole PATH.

**C LIBRARY FUNCTIONS** C aficionados will recognize the use of what are known as "standard library functions," that is, functions that are now available as a standard feature of any C compiler and that operate in a fairly uniform fashion. The standard library functions used here include

STRLEN()—which returns the length of a Null or Zero-terminated string;

STRNCMP()—which compares two strings for a specific number of characters;

TOUPPER()—which uppercases a character; and

PRINTF()—the standard C formatted print function.

Besides FIND\_ENV\_STRING() and GETVAR(), I had to create UPPER() (which calls TOUPPER() in a loop) to uppercase an entire string. The functions \_LMOVE() and \_SHOWDS() are provided by the DeSmet compiler in addition to the standard library functions. \_LMOVE() copies bytes across segments from one part of memory to another and \_SHOWDS() returns the value of

(continues)

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## ■ PC LAB NOTES

("Accessing the Environment" continued)

the current DS register in the 8088 chip.

For portability with Microsoft C and to show how the program could easily be recompiled with other compilers, I have provided a C macro early in the program. This is the line that reads

```
#define MSC FALSE
```

Changing the word FALSE to TRUE will enable a series of compilation controls that will let the program compile under MSC 4.0 without a hitch.

Included in these controls is a macro that tells the compiler to change `_LMOVE()` to `MOVEDATA()`, which is MSC's version of `_LMOVE()`. Another control at the end of the program forces the creation of `_SHOWDS()` for MSC (which doesn't have this function) but not for `DeSmet C` (which does have it).

The assembler program also revolves around the use of the `FIND_ENV_STRING` subroutine. Since assembler does not provide any type of standard library, however, I had to write all of the functions myself. Two powerful 8088 assembly language instructions used here are `REPE CMPSB`, to compare the environment variable requested with the one found in `GETVAR`, and `REP MOVS`, to copy an environment string to the local buffer in `FIND_ENV_STRING`.

You might notice that `PRINT_ENV_STRING` doesn't use the standard DOS function 9 for printing a string. This is because that function uses a dollar sign (\$) to terminate the string, and environment strings such as the `PROMPT` string may include a \$.

It's fairly easy to use these subroutines and functions in your own programs. In `READENV.C`, replace the contents of `MAIN()` with your own `MAIN()` (every C program must have one), or remove `MAIN()` completely for linkage with another program. For `READENV.ASM`, remove `MAIN` completely. Study the source listing to be sure you understand how `GETVAR()` and `FIND_ENV_STRING()` are called and what value they return, since this differs slightly between the C and assembler versions.

—Richard Hale Shaw

```
/* readenv.c RRS 12/15/86 rev.
 *
 * This program demonstrates how to:
 *
 * 1. Read the Environment strings from a C program.
 * 2. Find a specific environment variable and copy it and its string to a
 *    local buffer for further use.
 */
#include <stdio.h> /* Include standard C header file */
#include <time.h>
#define TRUE 1
#define FALSE 0
endif

/* This code was written utilizing the DeSmet C library functions.
 * For compatibility with some C compilers, some of the source code here may
 * have to be changed. For immediate compatibility with Microsoft C 4.0,
 * change the word FALSE on the following line to read TRUE.
 */
#define MSC FALSE
/* This will insure compatibility with Microsoft C 4.0.
 */

/* MSC
#include <memory.h>
#include <ctype.h>
#include <dos.h>
#define _lmove(nsrc, soff, aseq, doff, dseq) movedata(aseq, soff, dseq, doff, nsrc)
#define _pcb _pnp
endif

char *getvar(); /* declare functions returning pointers to characters */
extern unsigned _pcb; /* declare external variable that holds PSP value */

main() /* Our program begins here. */
{
    /* If the Environment variable passed to getvar() is found, this pointer
     * will receive from getvar() the address of a buffer where the entire
     * string will be placed. If the variable is NOT found, the pointer will
     * be set by getvar() to NULL.
     */
    char *path_string; /* declare the local pointer */

    /* Now, call SET() a function that initiates the DOS SET command by
     * reading the Environment strings one-by-one and printing them on
     * the console. It's code is included below.
     */
    set(); /* print the environment strings on the console */

    /* Next, call GETVAR() to find the PATH variable. If PATH is found,
     * the entire path string will be copied by GETVAR() to a buffer.
     * Then GETVAR() will return the address of the buffer, and place it in
     * path_string.
     */
    if (path_string = getvar("PATH"))
    /* So, if path_string is NOT NULL, it will point to the full PATH
     * variable, and we can print it on the console. We do this by
     * calling PRINT(). A standard library function, to print the string
     * pointed to by path_string.
     */
        printf("\n%s", path_string);
    exit(0); /* Exit this program */

    /***** SUBROUTINES: *****/
    /***** Subroutine Data *****/

#define ENVIRONMENT_OFFSET 8a2c /* Offset address of Environ. Copy in PSP */
#define MAXIMUM_ENV_STRING 127 /* macro for max. Environ. string length */

/* macros for controlling find_env_string() */
#define FIRST 1 /* find first string */
#define NEXT 0 /* find next string */

/* buffer in which to copy an Environment string - includes 2 extra
 * spaces for NULL-terminators at end of string or end of Environment.
 */
char env_string_buffer[MAXIMUM_ENV_STRING+2];

int env_offset = 0; /* variable for offset into the Environment */
unsigned Environment = 0; /* variable for Environment segment address */

/* SET() *****/
/* calls FIND_ENV_STRING() successively in a loop and prints each
 * environment string found, until the end of the Environment is found.
 */
set()
{
    int restart; /* restart variable */

```

(continued)

Figure C: A C program for reading and printing environment strings.

```

;-----
; READENV.ASM -- Reads Environment Strings
;-----
;This program reads the Environment strings to demonstrate:
; 1. How to find and print each of the strings in the Environment
; 2. How to search for and find an Environment string by
;    means of its variable name
;Program structure:
; 1. Read the entire Environment in a loop
; 2. Copy each string to a buffer
; 3. # terminate it
; 4. Print it
; 5. Find a particular string by variable name
; 6. Print it
;-----
CSEG                Segment
Assume              CS:CSEG, DS:CSEG, ES:CSEG, SS:CSEG
Org                100h
Jmp                Main

Entry:
;-----
;All data is here:
notice              db 'Copyright 1986 Tiff-Davis Publishing Co.'
notice2             db 'Programmed by Richard Hale Shaw'
Environment_Offset  equ $-notice
MAXIMUM_ENV_STRING equ 127
String_prefix       db 0Dh,0Ah
Env_string_buffer   db MAXIMUM_ENV_STRING+2 dup(0)
Env_offset          dw 0
Environment         dw 0
Variable_to_find    db 'path',0

;-----
Main:
    Call Set         ; Call subroutine to initialize DOS SET
; Next, find "PATH" and display entire string if found
; "PATH" is stored at Variable_to_find
    Lee $1,Variable_to_find ; Address of variable name
                                ; to find into $1
    Call Getvar       ; Get the variable
                                ; If CX is 0, not found, so
    Omp CX,0          ; Get out of program
    Je Exit           ; Else print the string found
    Call Print Env_string

Exit:
    Int 20h          ; Exit program

;-----
; Subroutines:
Set:
; Like the DOS SET command, reads each environment string
; and prints each one out
    Mov Word Ptr Env_offset,$ ; Set to search Environment
                                ; From the beginning

Find_string:
    Call Find Env_string ; Find a string
    Omp CX,0             ; If CX is 0
    Je End_set           ; No string found, go ahead
    Call Print Env_string ; else Call Print Environment
                                ; string routine
    Jmp Try_for_another_string
End_set:
    Ret                ; Return to caller

;-----
Getvar:
; requires $1 to point to NULL-terminated variable to find
; if CX is 0 upon return, the string was not found
    Mov Word Ptr Env_offset,$ ; Set to search Environment
                                ; From the beginning
    Call string_length ;Get length of variable to find
                                ; Pointed to by $1
    Omp CX,$             ; If length of string to compare is 0
    Je End_getvar        ; No variable compare
    Call Upper           ; Upper case the variable

Another_string:
    Push CX              ; Save CX (length of variable)
    Push $1              ; Save $1 (Address of variable)
    Call Find Env_string ; Find a string
    Pop $1               ; Get it back from stack
    Omp CX,0             ; If CX is 0
    Pop CX               ; Restore CX from stack
    Je Not_found         ; String not found

    Cld                 ; Clear direction flag
    Push $1              ; Save Address of variable
    Push ES              ; Save ES on stack
                                ; (continues)

```

Figure D: An assembler program for reading and printing environment strings.

ettes or hard disk. Do not copy it to your master (original) DOS diskette.

**USERS OF DOS 3.0-3.1** If you have DOS, Version 3.0 or 3.1, there is an undocumented solution similar to the one available to DOS 3.2 users described above. (When a solution is referred to as "undocumented," it means that the solu-

■ A solution referred to as "undocumented" works, possibly with limitations, although the manufacturer hasn't acknowledged it.

tion works, possibly with some limitations, although the manufacturer hasn't acknowledged it.) To increase the environment under DOS 3.0-3.1, make the following entry in CONFIG.SYS:

```
SHELL=COMMAND.COM /e:xx /p
```

where xx refers to the number (from 10 to 62) of 16-byte memory paragraphs to reserve for the environment. You'll note that this procedure differs from the example for DOS 3.2 above, in which the variable xx referred to the actual number of bytes to reserve. Again, the /p forces the loading of AUTOEXEC.BAT and should always be included.

**USING SETENV FOR DOS 2.0-3.1** If you have Microsoft's SETENV.EXE, its use is simple. Enter

```
SETENV COMMAND.COM <size>
```

where <size> is the size (in bytes) of the environment block you wish to reserve, a number from 160 to 992. SETENV will round this up to an even paragraph value (a multiple of 16). You can use a larger number if you wish, but Versions 2.0-3.1 of DOS include a routine that limits the environment block size to a maximum of 992 bytes even if you try to exceed that figure.



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## ■ PC LAB NOTES

**PATCHING WITH DEBUG** If you don't have DOS 3.2 or SETENV, and the other solutions for expanding the environment don't suit your taste, you've still come to the right place. Listed below are some quick-and-dirty DEBUG patches to COMMAND.COM you can make in the privacy of your own home.

To use them, select the patch script for the version of DOS you are using, and prepare a new diskette formatted with the /S option. Copy DEBUG to the diskette. Then enter the following at the DOS command prompt:

```
DEBUG COMMAND.COM < ENVPATCH.SCR
```

where ENVPATCH.SCR is the name of the appropriate DEBUG patch script file.

The script below can be created with an ASCII word processor, with EDLIN, or if

■ Here are some quick-and-dirty DEBUG patches to COMMAND.COM you can make in the privacy of your home.

you remember to add the final Ctrl-Z and hit Enter) with COPY CON. It patches COMMAND.COM for DOS 2.0 and 2.1, setting the environment size at its maximum, 992 bytes—a substantial improvement over 160. If you prefer a somewhat smaller environment size, all you have to do is change the last number on the first line to the hexadecimal value of the number of 16-byte paragraphs you want your environment size to be. This can be any number from 0Ah to 3Eh (10 to 62 decimal) paragraphs. For instance, to reserve 512 bytes of environment space, you would change the number to 20 (hex for 32; 32 \* 16 = 512).

For DOS 2.0 and 2.1 the three lines that constitute the file ENVPATCH.SCR are:

```
E ECF 3E
W
Q
```

```
/* Initialise restart to find FIRST string.
 * Call FIND_ENV_STRING() as long as it returns TRUE.
 * Set restart to find NEXT string after the first call.
 */
for( restart = FIRST ; find_env_string(restart); restart = NEXT)

/* Call PRINTF() to print contents of buffer */
printf("Name: env_string_buffer");

/* GETVAR() *****
 * Calls FIND_ENV_STRING() repeatedly until an Environment string
 * with "name" as the variable name is found, or until FIND_ENV_STRING()
 * returns FALSE, signaling that the end of the Environment was reached.
 * If the string with the right variable name is found, GETVAR() returns
 * a pointer to the Environment string buffer, otherwise it returns a
 * NULL.
 */
char *getvar(name)
char *name;
{
    int len; /* variable to hold length of name */
    int restart; /* variable to hold search control */

    /* Call standard library function STRLEN() to get the
     * length of name and place it in len.
     */
    len = strlen(name);

    /* Call function UPPER() to force name to upper case, since
     * DOS forces all Environment variable names to upper case.
     */
    upper(name);

    /* Main search loop:
     * Set restart for search for 1st environment string.
     * Loop while FIND_ENV_STRING() returns TRUE.
     * Reset restart for search for further environment strings.
     */
    for( restart = FIRST ; find_env_string(restart); restart = NEXT)

    /* Try to match the variable name with the last characters in the
     * Environment string found. Make sure that the last character past
     * the end of the name in the string is a '\0' so we really have the
     * whole string. This way we don't confuse PATH, for instance, with
     * some other string like PATH\
     */
    if(strlen(name, env_string_buffer, len) && env_string_buffer[len] == '\0')

    /* If a match, return the address of the buffer */
    return env_string_buffer;

    /* Otherwise, we broke out of the loop which means we didn't find the
     * string. So return a NULL.
     */
    return (char *)NULL;
}

/* FIND_ENV_STRING() *****
 * Finds the Environment strings, and copies the last one into
 * env_string_buffer, as long as restart is equal to FIRST. If
 * NOT, finds the next successive string and copies it into the buffer.
 * Returns TRUE if a string is found, or FALSE if end of Environment is
 * found.
 */
find_env_string(restart)
int restart;
{
    int buffer_offset; /* variable for offset into env_string_buffer */
    unsigned _shows();

    /* If the Environment address has NOT already been obtained, */
    if(!Environment)

    /* Get the segment address of the current DOS Environment copy into the
     * variable Environment. _SHOWCS() and _SHOWDS() are DOS C functions
     * that return the current Code and Data segment register values respectively.
     * _LMOW() is a DOS C function that moves a variable number of bytes
     * from an offset in one segment to an offset in other segment. Here we
     * move 2 bytes from offset 1ch in the DS (which is at Code Segment+2ch
     * is CS, to the address of "Environment" in the current Data Segment.
     */
    _lmove( 2, ENVIRONMENT_OFFSET, _pch, &Environment, _shows());

    /* If we want to start with the last string, reset env_offset to zero.
     */
    if(restart)
        env_offset = 0;

    /* Initialize buffer offset to zero.
     * Loop continuously until the end of an Environment string is found.
     * Increment the Environment Offset by 1 at the end of every loop.
     */
}
```

(to appear C continues)

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```

Push    DS                ; Save DS on stack
Pop     DS                ; Put DS into DS
Lee     DI, Env_string_buffer ; Address of buffer into DI
Push    CX                ; Save length on stack
Repeat  Cmpb             ; Compare the two strings
Pop     CX                ; Restore length
Pop     SI                ; Restore SI
Pop     SI                ; Restore variable address
Jne     Another_string    ; If 'a' next character
Cmp     Byte Ptr [DI], 'a' ; Got it, length in CX, get out
Jne     Not_found
Not_found:
Xor     CX, CX            ; Don't have it, clear CX
End_getter:
Ret                             ; Return to caller

;-----
String_length:
; require SI to point to string to get length of
; Length of string in CX on return
; String should be NULL-terminated

Push    SI                ; Save SI on stack
Xor     CX, CX            ; Clear CX to 0
Next_one:
Cmp     Byte Ptr [SI], 0    ; If 0 found
Je      End_string        ; Go to End string
Inc     CX                ; Add 1 to count in CX
Inc     SI                ; Next byte to compare
Jmp     Next_one          ; Compare next one
End_string:
Pop     SI                ; Restore SI from stack
Ret                             ; Return to caller

;-----
Print_Env_string:
; Print a NULL-terminated Environment string pointed to by
; Env_string_buffer
; Call int 21h function 2 to print each character
; Terminate when NULL-terminator is reached

Push    SI                ; Save SI on stack
Lee     SI, String_prefix ; Load address of buffer into AX
Print_another:
Mov     DL, Byte Ptr [SI]   ; Character to print into DL
Cmp     DL, 0              ; If character is zero
Je      End_Print_Env_string ; Get out
Mov     AH, 2              ; Function to print string
Int     21h               ; Call DOS
Inc     SI                ; Point to next character
Jmp     Print_another      ; Loop back
End_Print_Env_string:
Pop     SI                ; Restore SI
Ret                             ; Return to caller

;-----
Find_Env_String:
; Find an Environment string beginning with the first
; One. Copies each to the Env_string_buffer. If End
; of Environment found, places zero in buffer, and CX
; is 0.
Cmp     Word Ptr Environment, 0 ; See if Environment address
; is available
Je      Get_Env_string        ; If Available, Get a string
; If not,
Mov     AX, CB[2Ch]          ; Get Environment address
Mov     Word Ptr Environment, AX ; Store Environment address
Get_Env_string:
Lee     DI, Env_string_buffer ; Address of buffer into DI
Mov     SI, Word Ptr Env_offset ; Current Environment Offset
; into SI
Mov     AX, DS              ; Get DS into AX
Mov     ES, AX              ; And put it in ES
Mov     AX, Word Ptr Environment ; Get Environment Segment Addr.
Mov     DS, AX              ; Put it into DS
Xor     CX, CX              ; Clear CX to 0
Push    SI                ; Save SI on stack
Next_byte:
Cmp     Byte Ptr [SI], 0    ; Check for End of Environment
; String
Je      End_Env_string      ; If found, break out of loop
Inc     CX                ; Add 1 to count
Inc     SI                ; Point to next byte
Jmp     Next_byte          ; Loop back to check next byte
End_Env_string:
Pop     SI                ; Restore SI from stack
Cmp     CX, 0              ; If CX is 0
Je      End_Find_Env_string ; Nothing to move, goto finish

```

(Figure D continues)



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## ■ PC LAB NOTES

```
for( buffer_offset = 0; TRUE; env_offset++) {
    /* Copy 2 bytes from the environment offset in the Environment
     * segment, to the buffer_offset in the Environment string buffer.
     */
    _leave( 2, env_offset, Environment,
           env_string_buffer[buffer_offset], _showds());

    /* If a Non-zero character was found and placed in the current
     * offset in the buffer, loop back for another one.
     */
    if(env_string_buffer[buffer_offset]){
        buffer_offset++;
        continue;
    }

    /* We must have found a zero to get this far without looping back.
     * If buffer_offset is zero, the last character found was a zero and
     * we are at the end of the Environment strings - return FALSE.
     */
    if( !buffer_offset)
        return FALSE;

    /* Otherwise, We have found the end of a string, so increment the
     * Environment offset by one to point to the next one for next time.
     * Then return TRUE (TRUE that we did NOT find the end of the
     * Environment strings.
     */
    env_offset++;
    return TRUE;
}

/* UPPER() *****
/* Uppercases the string passed by calling the standard library function,
/* toupper(), which returns the uppercase version of a single character.
/*
upper(string)
char *string;
{
    /* A simple "FOR" loop in C:
     * Nothing is initialized.
     * Loop as long as the character pointed to by string is not a zero
     * (a NULL-terminator).
     * Then increment the pointer to point to the next character.
    */
    for( ; *string; string++)
        /* For each character, call TOUPPER() to return the uppercase
         * version of the character, and set the character to it.
         */
        *string = toupper(*string);
}

/* MIC
/* _SHOWDS() *****
/* Returns DS register value.
/*
unsigned _showds()
{
    struct SREGS segregs;
    segregs(segregs);
    return segregs.ds;
}

#endif

/***** End of Readenv.c *****/
```

(Figure C ends)

To modify the script for DOS 3.0 and 3.1, make the changes to line 1 shown here: For DOS 3.0 line 1 should be

E F2C 3E

For DOS 3.1 line 1 should be

E D11 3E

**TESTING YOUR CHANGES** To test your changes, simply reboot your machine with the diskette containing the newly modified COMMAND.COM program. This removes any programs (including

memory-resident programs) from memory that might change the test results. Then run TESTENV.BAT.

TESTENV.BAT, shown in Figure 1, is a batch file I created to test the size of your environment. You can run it at any time, whether or not you have expanded your environment size. TESTENV calls upon a second program, ENVVCOUNT.COM, which counts the number of bytes of space being used in the environment. The assembler listing for ENVVCOUNT (use either the IBM or Microsoft Macro Assembler) is shown in Figure 2, and a BASIC program



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## ■ PC LAB NOTES

```

Move_bytes:
    Push    CX                ; Save count on stack
    Mov     AX,SI             ; Put SI offset into AX
    Add     AX,CX             ; Add number of bytes found
    Inc     AX                ; Add one
    Mov     Word Ptr [Env_Offset],AX ; Set Env_offset for
                                ; correct environment offset
    Cld                     ; Clear direction flag for forward move
    Rep     Movsb             ; Copy bytes from environment to buffer
    Mov     Byte Ptr EB:[DI],0 ; Set last byte to zero
    Pop     CX                ; Restore count from stack

End_Find_Env_strings:
    Mov     AX,EB             ; Set Data Segment back into
    Mov     DX,AX             ; DS
    Ret                     ; Return to caller

=====
Upper:
    ; Uppercase the Null-terminated string pointed to by SI
    Push    SI                ; Save SI Pointer
    Upper_Another:
        Cmp     Byte Ptr [SI],0 ; If Null
        Je      End_upper
        Mov     Byte Ptr [SI],32 ; Get out
        Inc     SI             ; Uppercase the character
        Inc     SI             ; Increment SI to next character
        Upper_Another         ; Uppercase the next character
    End_upper:
        Pop     SI            ; Restore SI from stack

;=====
EndProg    Label    Byte      ; End of program
CSEG
End Entry

; End of Readenv.asm

```

(Figure D ends)

that will create ENVCOUNT.COM when you run it once is shown in Figure 3. These and other programs in this column are also available without charge for downloading by modem, as explained in the sidebar "Downloadable Lab Notes."

TESTENV operates in this way: it creates a series of temporary environment strings to attempt to fill up environment space. Then ENVCOUNT is run to tell you how much space is used. I've set TESTENV to add up to 1280 bytes of strings to the environment here, which will be sufficient under DOS 2.0-3.1 (where you can't have more than 992 bytes in the environment). For testing larger environments under DOS 3.2, simply add some additional string initializations (G,H,I, etc., or 10,11,12, etc.). You won't damage anything by trying to overflow your environment.

ENVCOUNT.COM counts the number of bytes actually occupying the environment. After counting, it prints the message: "The Environment is currently using: XX bytes," where XX is the number it counted. You can use ENVCOUNT either as a separate command at the DOS prompt or invoke it automatically by running TESTENV.BAT.

## ■ Only a few of today's popular programs take advantage of the DOS environment.

**CONCLUSIONS** Only a few of today's popular programs take advantage of the DOS environment. Most of the new Microsoft languages do so, including Microsoft C, QuickBASIC, and some of the language utilities, but many more applications programs should.

I hope that this article and its related examples will have shed some light on the environment and how it is used. I'm looking forward to seeing new uses for the environment, and perhaps software authors as well as PC Magazine's power users will begin to make greater use of it.

*Richard Hale Shaw is a microcomputer consultant and software engineer who works in Louisville, Kentucky.*

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## ■ PROGRAMMING/UTILITIES

## RX for DIREX

A number of readers have correctly noted that Steven Holzner's DIREX.COM (Programming/Utilities, Volume 6 Number 1) does not have the ability to handle files that are larger than 62K properly. Corrected versions of DIREX.COM, DIREX.ASM, and DIREX.BAS can be downloaded from the PC Magazine Interactive Reader Service, or you can make the necessary changes to these files manually, as described below.

For DIREX.COM, use DEBUG to change F8 to F4 at the two addresses shown, as follows:

DEBUG DIREX.COM

E 535 F4

E 55D F4

W

Q

For DIREX.ASM, all you have to do is change the line

MOV CX, 62\*1024

near the bottom of page 300 in the printed listing to

MOV CX, 61\*1024

Similarly, on page 301 of the listing, change

CMP BYTES\_READ, 62\*1024

to

CMP BYTES\_READ, 61\*1024

For DIREX.BAS, change the 248 in the sixth column of lines 1630 and 1680 to 244 and correspondingly change the line checksums (column 9) for these lines to 1061 and 962, respectively. The overall program checksum (line 270) must be decreased to 197795 to reflect the changes above.

Our thanks to Bob Pirkio of New York for these patches, and our apologies to readers who were inconvenienced.—Ed.

```

                db 2Ah,2Fh,13h
                db 'No Files Found',0
start:
;
;Execution comes here thru interrupt 9 every time a key is pressed or released.
;
keyboard:
    proc near
    esi
    push ax
    in al,40h
    cmp al,52
    jne kb1
    mov ax,2
    int 16h
    test al,0
    je kb1
    call kb_reset
    pop ax
    cmp program_status,0
    jne kb1
    mov request_flag,1
    iret
    kb1:
    pop ax
    jmp keyboard_int
    endp
;
;Interrupt 1Ch handling routine.
;
timer:
    proc near
    pushf
    call timer_int
    cmp request_flag,0
    je timer1
    push ax
    push di
    mov es,doc_segment
    mov di,busy_flag
    cmp byte ptr es:di,0
    pop di
    pop ax
    jne timer1
    cmp flag_13h,0
    jne timer1
    mov ax,20h
    out 10h,ax
    mov request_flag,0
    call directory
    timer1:
    timer
    endp
;
;Interrupt 13h handling routine.
;
bdiack:
    proc near
    inc flag_13h
    pushf
    call bdiack_int
    dec flag_13h
    jret
    endp
;
;Interrupt 20h handling routine.
;
backproc:
    proc near
    pushf
    call bp_int
    cmp request_flag,0
    je bpl
    mov request_flag,0
    call directory
    bpl:
    backproc
    endp
;
;Interrupt 24h handling routine.
;
ioerr:
    proc near
    sti
    mov error_flag,1
    mov ax,0
    iret
    endp
;
;DIRECTORY is called by other routines to pop up and control the window.
;
directory:
    proc near
    mov program_status,1
    sti
    push ax
    push bx
    push cx
    push dx
    push si
    push di
    ;set interrupt enable flag
    ;save AX
    ;get even code from keyboard
    ;was the '.' key pressed?
    ;no, then exit to error handler
    ;check shift key status
    ;is the Alt key pressed?
    ;no, then exit
    ;reset keyboard, leave BDI
    ;restore AX
    ;BDI routine already active?
    ;yes, then don't set request flag
    ;set request flag
    ;end interrupt routine
    ;restore AX
    ;go to original keyboard routine
    ;cell original routine
    ;request flag set?
    ;no, then exit
    ;save ES and DI
    ;get DOS segment in ES
    ;address of DOS BUSY_FLAG in DI
    ;DOS service currently active?
    ;clean up the stack
    ;yes, then we must wait
    ;DOS disk service active?
    ;yes, then don't interrupt it
    ;leave BDI to 0259 PIC
    ;reset request flag
    ;invoke directory routine
    ;done - exit
    ;cell original routine
    ;clear flag
    ;cell original routine
    ;request flag clear?
    ;yes, then exit
    ;clear request flag
    ;invoke directory routine
    ;done - exit
    ;set external error flag
    ;tell DOS to ignore the error
    ;give control back to DOS
    ;set program active flag
    ;enable interrupts
    ;save registers

```

(Figure 1 continues)

```

push ds
push es
push cs
pop ds
assume ds:code
push cs
pop es

; Make sure the current video mode is a test mode.
mov ah,15
int 10h
cmp al,2
je dir1
cmp al,3
je dir1
cmp al,7
je dir1
exit:
mov program_status,8
pop es
pop ds
pop di
pop si
pop ds
pop cs
pop bx
pop ax
ret

; Save video parameters that must be used now or restored later.
dir1:
mov video_page,bh
mov es,1
int 10h
mov cursor_mode,cs
call cursor_address
mov cursor_pos,ax
cld

; Save the screen contents and open the directory window.
cmp adapter,1
jne dir2
call disable_cga
call save_screen
call open_window
cmp adapter,1
jne dir3
call enable_cga

; Set the DPA and interrupt 24h vector to areas inside XDIR. Then get a
; directory path string from the keyboard.
dir3:
call loadt
dir4:
mov di,path
mov ds,$28Ah
mov ci,$9
call readln
cmp al,27
jne dir5
jmp escape
push cs
mov es,1
mov ch,$28h
int 10h
pop cs
mov dx,offset global1
or cl,1
je dir7
cmp byte ptr [di-1],'\ '
jne dir6
dec di
inc si,global
mov cs,$
xchg movah
mov ds,path
; point DX to path string

; Read filename information from the specified directory.
dir7:
call get_dir
mov di,path
or cs,cs
jne dir9

; No files were found - print message and return to input loop.
mov dx,$721h
lea si,error_text
call write_string
call getkey
call clear_input_line
call clear_window
jmp dir4

; One or more files were found. Display them and look for keystrokes.
dir9:
call write_dir

```

(Figure 1 continues)

pathname, you'll get a listing of the files in that directory. The window can display 40 filenames at a time. If there are more than 40 files in the directory, the first 40 are exhibited initially and the entire list can be examined using the PgUp and PgDn keys to move backward and forward. Up to 360 filenames can be read in and buffered. Filenames beyond that limit are ignored by the program.

Pathname specifications follow the standard DOS format. To view contents of the root directory of drive A:, for example, simply type A: or A:\ at XDIR's input prompt. You could examine the contents of the subdirectory DISKUTIL located several levels down from the root directory on the C: drive like this:

C:\UTIL\PCMDISKUTIL

Any reachable directory is a valid target for XDIR.

When you're finished with a directory listing, press the Esc key once to clear the directory window and return to the input prompt. At that point, you can either enter another pathname and start another search or press Esc again to close the window and return to the interrupted applications program. Pressing the Esc key by itself while typing a pathname will also close the directory window.

You can obtain a listing for the current working directory simply by hitting the Enter key with the input line empty. No pathname is required. XDIR shows only "normal" files, i.e., those that aren't hidden and are neither system files nor subdirectories. If that doesn't suit your needs, one small change with DEBUG will allow the program to display any or all files found, regardless of their attributes. That process will be outlined later.

If you request a search of a directory that contains no files, XDIR will respond by printing the message "No files found" inside the window. Simply pressing any key will then return you to the input line. Note that the same message is issued if you specify an illegal or nonexistent pathname, or if you accidentally attempt to read a directory from an empty drive. The press of any key will let you recover from the error unscathed. To use XDIR in parallel with SideKick, just be sure to load XDIR first in accordance with the exhortation in the





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```

mov al,16h          ;row * 16h
mul dh              ;column * 2
shl dl,1            ;byte to word in DX
mov dx,dh           ;add the results
mov dx,dx           ;save result in DI
mov ax,1000h        ;length of one video page
mul bx              ;page * 1000h
add result to DI

video_offset
endp

;-----
;DISABLE_CGA and ENABLE_CGA disable and enable CGA video output.
;-----
disable_cga
proc near
disable:
mov dx,304h         ;address of Status Register
in al,dx            ;get status
test al,4           ;vertical retrace active?
jnz, then wait
sub dx,2            ;MSR address is DI
mov al,12h          ;value to disable video
out dx,al           ;disable video output
ret
endp

enable_cga
proc near
mov ah,15           ;get video mode
int 10h             ;value in AL
lea bx,enable_values ;get value to enable display
xlat                ;MSR address
mov dx,304h        ;enable video output
out dx,al
ret
endp

;-----
;KB_RESET resets the keyboard and issues an EOI to the 8259 PIC.
;-----
kb_reset
proc near
in al,61h           ;get current control value
mov ah,al           ;save it in AH
or al,80h           ;set the high bit
out 61h,al          ;send it to the control port
mov al,ah           ;recover original value
and al,80h          ;send it out
;suspend interrupts
load EOI value
;send it to the 8259
;restore interrupts
ret
endp

;-----
;SHOW_CURSOR sets the cursor to its default state.
;-----
show_cursor
proc near
mov ah,1            ;interrupt 16h service 1
mov cx,default_cursor ;set scan line definition
int 10h             ;set cursor shape
ret
endp

;-----
;CURSOR_ADDRESS reads the current cursor position from the video controller.
;-----
cursor_address
proc near
mov dx,addr_6845    ;get CRTS Address Register port
mov al,14           ;OUT register number
out dx,al           ;point DX to Data Register
inc dx              ;read high byte of cursor address
mov ah,al           ;save it in AH
dec dx              ;point DX back to Address Register
mov al,15           ;OUT next register number
out dx,al           ;point DX to Data Register
inc dx              ;read low byte of address
and ax,07FFFh       ;strip "page" bits from address
mov bl,00           ;then divide by 98
div bl              ;reverse bytes for proper form
mov ah,al           ;
ret
endp

;-----
;JORTKEY waits for a keypress and returns the keycode in AX.
;-----
jortkey
proc near
mov ah,1            ;check keyboard buffer
int 16h            ;jump if buffer contains a keycode
jne getkey          ;no key pressed - issue int 16h
jmp getkey          ;loop back to try again
getkey1:
mov ah,0            ;get keycode from buffer
int 16h

```

(Figure 1 continues)

## ■ PROGRAMMING/UTILITIES

it off is the distinction between the two classes of resident utilities.

There are a couple of things to be understood before embarking on a discussion of how DOS routines can be used inside resident utilities. The first is why the DOS interrupts can be executed without discretion from a normal application but can't be from within an interrupt handler. The reason is that DOS services are non-reentrant. Non-reentrancy means that one routine can't call another.

Normally, of course, the programmer has no means of calling one DOS service from inside another because once an interrupt 21h is executed, control of the system is revoked until DOS transfers it back with an IRET instruction. But if a memory-resident program interrupts a DOS service in progress (and at any given time a DOS service may very well be in progress) and then itself issues an interrupt 21h, the reentrancy problem arises. The roof usually won't fall in until the *second* call completes its processing and the resident utility tries to pass control back to whatever was running when it was invoked, but the collision is sure to come and it's sure to be messy.

The second thing to understand is just why DOS routines are non-reentrant. When an interrupt 21h is executed, one of the first steps DOS takes is to switch to one of three internal stacks it maintains. The same is true with interrupts 25h and 26h. The switch is accomplished by simply saving the contents of the SS and SP registers for restoration upon exit, then changing them to point to an area of memory set aside within the operating system's reserved workspace. If one routine calls another, everything that was stored on the stack by the first (like the register values on entry) is overwritten by the second. One of the items likely to be destroyed is the return address of the second routine, which was pushed onto the stack by the microprocessor when the interrupt instruction was processed. Thus, when the latter routine executes an IRET, control is vectored to some random place in memory where it was never intended to go.

Which internal stack is used depends on the interrupt number and, for interrupt 21h, the function number. Interrupts 25h and 26h always use the same stack. Inter-

```

getkey      zet          ;set with keycode in AX
            endp

=====
;OPEN_WINDOW writes the blank directory window to display memory.
open_window
    proc near
    push ax
    mov ax,video_segment
    mov di,video_address
    mov al,21h
    mov ah,border_attr
    stoww
    mov cx,63
    mov al,32
    rep stoww
    mov al,191
    stoww
    add di,32
    mov cx,18
    push cx
    mov al,179
    mov ah,border_attr
    push ax
    stoww
    mov cx,63
    mov al,32
    mov ah,task_attr
    rep stoww
    pop ax
    stoww
    add di,32
    pop cx
    loop open
    mov al,192
    stoww
    mov cx,63
    mov al,196
    rep stoww
    mov al,217
    stoww
    pop ax
    ret
    endp

=====
open_window
;
;READLN accepts input of a string entered from the keyboard.
;format: ES:DI = buffer address | tail: CL = string length
;       DS:06 = cursor start position |
;       CL = max length accepted |
;
readln
    proc near
    mov ax,es,di
    mov bh,video_page
    int 10h
    call show_cursor
    mov cx,cl
    call getkey
    cmp al,13
    je read_exit
    je read_exit
    cmp al,27
    je read_exit
    cmp al,8
    je backspace
    cmp al,32
    jb readl
    cmp cl,maxlen
    push ax
    push cx
    mov ah,18
    mov cx,1
    int 10h
    inc di
    mov ah,2
    int 10h
    pop cx
    pop ax
    stoww
    inc cl
    jmp readl
    or cl,cl
    je readl
    push cx
    dec di
    mov ah,2
    int 10h
    mov ah,18
    mov al,32
    mov cx,1
    int 10h
    pop cx
    dec cl
    dec di
    jmp readl
    endp

=====
;save ES
;set ES:DI to video memory
;write first character
;
;then do the next 62
;
;finish the first line
;
;set DI to start of next line
;18 lines to do
;save line counter
;write first character on line
;
;save character/attribute pair
;write them to video memory
;write next 62 characters
;
;retrieve saved word for final char
;finish the line
;set DI to start of next line
;restore line counter
;loop until 18 lines are done
;first character of last line
;
;write the next 62 characters
;
;finish the last line
;
;restore ES
;
=====
;save max length
;set cursor to start position
;
;make sure cursor is visible
;initialize counter
;get a character
;ENTER key?
;yes, then exit
;ESC key?
;yes, then exit
;backspace key?
;yes, then do backspace function
;ASCII 12 or greater?
;no, then ignore it
;room for another entry?
;no, then ignore it
;save character just entered
;save character count
;print the character
;
;advance the cursor
;
;retrieve count
;retrieve character
;deposit entry in buffer
;update count
;go back for more
;any characters to delete?
;no, then ignore keystroke
;save count
;move cursor back one space
;
;print a space character
;
;retrieve count
;decrement it
;decrement buffer pointer
;go back for more

```

(Figure 1 continues)

```

read_exit:      ret                ;exit
readin         endp

;-----
;IOERR saves the current DTA address and interrupt 24h vector, then replaces
;them with pointers to XD1R routines.  IOERR restores the original values.
;-----
ioerr          proc near
    push es
    mov ah,25h
    int 21h
    mov old_dta_segment,es
    mov old_dta_offset,bx
    mov ah,1ah
    mov dx,dta
    int 21h
    mov ah,25h
    mov ei,24h
    int 21h
    mov old24h_segment,es
    mov old24h_offset,bx
    mov ah,25h
    lee dx,ioerr
    int 21h
    pop es
    ret
ioerr          endp

;-----
;ioreset
proc near
    mov ah,25h
    mov ei,24h
    mov dx,old24h_offset
    push dx
    assume ds:nothing
    mov dx,old24h_segment
    int 21h
    mov ah,1ah
    mov dx,old_dta_offset
    mov dx,old_dta_segment
    int 21h
    pop dx
    assume ds:code
    ret
ioreset        endp

;-----
;GET_DIR reads the specified directory and stores the ASCII filename text.
;Entry: DS:DX = pathname
;Exit: CX = number of files
;-----
get_dir        proc near
    mov error_flag,0
    mov ah,42h
    mov cx,search_attr
    int 21h
    mov cx,0
    jc getdir4
    mov error_flag,0
    jne getdir4
    inc cx
    mov di,txt_buff
    call copy_filename
    mov ah,4fh
    int 21h
    jc getdir2
    cmp error_flag,0
    jne getdir2
    call copy_filename
    inc cx,36h
    jne getdir1
    jmp di,13
    cmp byte ptr es:[di],0
    dec byte ptr es:[di]
    mov ax,cx
    dec ax
    mov hi,40
    div bl
    mov max_page,al
    ;save highest page number
    getdir4:
    get_dir     ret
    endp

;-----
;COPY_FILENAME copies an ASCII filename from the DTA to the indicated address.
;Entry: ES:DI = destination address
;-----
copy_filename  proc near
    mov si,dta
    add si,10
    push cx
    mov cx,13
    rep movsb
    pop cx
    ret
copy_filename  endp

```

(Figure 1 continues)

rupt 21h functions 1 through 0Ch and a few higher-numbered ones use another stack. Functions 0 and 0Dh and higher (with a few exceptions) use the same stack employed by interrupts 25h and 26h. (There are even provisions within DOS to let one routine call another and avoid the stack switch. DOS is one complicated piece of code, and exceptions will be found to almost any blanket generalities.)

Why some applications, like DOS, choose to use an internal stack is a matter of programming philosophy. BIOS routines are reentrant (a flexibility the video BIOS takes advantage of) because they don't employ a special stack. They rely instead on the assumption that the program that calls them has enough stack space to handle the PUSHING and POPING of several words. In almost all cases that's a safe assumption. Many memory-resident utilities use their own stack, however, to make absolutely sure that their stack requirements won't overtax the system and crash the computer. The trade-off is that simply using the default stack is easier, requires less code, and is usually a sound practice. It's a shortcut often taken without being given a second thought.

**ACCESS TO DOS SERVICES** Working around the non-reentrant characteristic of DOS services to allow a resident utility to make use of them boils down, then, to making sure that your routine will take control only when an interrupt 21h, 25h, or 26h is not being processed. The obvious way to accomplish that would be to intercept calls to each, set a flag indicating that processing is taking place when a DOS service is requested, and clear that flag upon exit. But there is an easier way, as we shall see.

As it happens, DOS itself maintains an internal flag, sometimes called the Busy Flag, that any program can access to see whether a DOS routine is currently active. The address of that flag is obtained by calling interrupt 21h, function 34h. The segment address is returned in ES and the offset in BX. By checking that byte within the operating system's work area before activating a pop-up utility, and by refusing to hand control to it if the byte is nonzero, a program can ensure that one service call will not overlay another.



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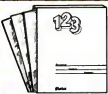
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## ■ PROGRAMMING/UTILITIES

If you look up DOS function 34h in the *DOS Technical Reference* (or almost any programming manual, for that matter), you'll find it simply listed as "Used internally by DOS." That explains why the knowledge of how to use DOS services in memory-resident code isn't widespread: Microsoft didn't document services like 34h, apparently in an attempt to discourage programmers from using them. All of us paid good money for DOS—and an outrageous amount for the *Technical Reference*—yet Microsoft won't treat us as programming adults. Fortunately, other people have spent a great deal of time investigating these forbidden territories (and disassembling PRINT.COM), and they have passed the useful information on to the interested public.

A few sharp programmers may have already spotted a problem in the offering. If resident utilities are to be prevented from acting when a DOS interrupt routine is in progress, what happens if a request for the resident program occurs during the execution of a prolonged function like 0Ah, which reads an entire line of text from the keyboard? It's a real problem, because function 0Ah is active when DOS awaits command line input adjacent to the A> prompt.

Enter interrupt 28h, another undocumented DOS resource vital to the programming of advanced resident code. When function 0Ah is waiting for a key-stroke, it continually issues calls to interrupt 28h that can be picked up by anyone caring to intercept them. When an interrupt 28h is executed, DOS services higher than 0Ch may be safely invoked without risk of causing a system crash even if the DOS Busy Flag is set. A resident routine can set up its own interrupt 28h handler and feel secure in utilizing interrupt 21h from inside it.

Just why we can use only services numbered higher than 0Ch from within an interrupt 28h routine is answered by remembering how DOS is structured. Of the three internal stacks that DOS maintains, one is used almost solely for calls to services 1 through 0Ch. Interrupt 28h is executed only by DOS routines in that range. Thus non-reentrancy restrictions are circumvented if calls to functions numbered higher than 0Ch are used and calls to 0Ch or

```

;-----
;WRITE_DIP writes one page of directory data to the directory window.
write_dir proc near
    mov ax,flag,8 ;initialize END_FLAG
    mov ax,528 ;528 bytes per directory page
    mov bl,dir_page ;get page number in BL
    mov bh,bb ;byte to word in BX
    mov bx ;find offset into TEST_BUFFER
    mov al,ax ;transfer offset to SI
    add si,ax ;complete address calculation
    mov dx,850Ah ;specify starting cursor position
    mov cx,16 ;do 16 lines
    wdir4: push cx ;save line counter
        call write_line ;write one line
        inc dx ;move cursor to next line
        mov di,16 ;restore line count
        pop cx ;END_FLAG set?
        cmp ax,flag,8 ;yes, then terminate
        loop wdir4 ;loop until all lines are done
    wdir5: ret
    write_dir endp
;-----
;WRITE_LINE writes a single line of directory text to the display.
;Entry: DH,DL = starting row and column
write_line proc near
    mov cx,4 ;4 entries per line
    wline1: push cx ;save counter
        push si ;save text address
        push dx ;save cursor address
        call write_string ;write one entry
        pop dx ;retrieve cursor address
        add di,16 ;set cursor to next field
        pop si ;retrieve text address
        add si,13 ;set it for next write
        pop cx ;retrieve count
        cmp ax,flag,8 ;END_FLAG set?
        jne wline2 ;yes, then exit
        loop wline1 ;loop until done
    wline2: ret
    write_line endp
;-----
;WRITE_STRING writes an ASCII string to the display.
;Entry: DH,DL = starting row and column
;       DS:SI = string address
write_string proc near
    mov ah,2 ;set cursor to start position
    mov bh,video_page
    int 10h
    wstr1: mov cx,1 ;output one character at a time
        lodsb ;get a character
        or al,al ;is it a zero?
        jz wstr2 ;yes, then exit
        int 21h ;is it 255?
        jnz wstr2 ;yes, then set END_FLAG and exit
        mov ah,10 ;print character
        int 10h ;advance cursor
        inc di
        int 10h
        jmp wstr1 ;loop until done
    wstr2: mov ax,flag,1 ;set END_FLAG
        ret
        write_string endp
;-----
;CLEAR_WINDOW clears the contents of the directory window.
clear_window proc near
    mov ah,6 ;clear window with BIOS routine
    mov al,0 ;specify clear function
    mov cx,850Ah ;specify window coordinates
    mov dx,8C45h ;attributes to be used
    mov bh,video_page
    mov bh,video_page
    int 10h
    ret
    clear_window endp
;-----
;CLEAR_INPUT_LINE clears the window input line.
clear_input_line proc near
    mov ah,2 ;set cursor to start of input line
    mov dx,850Ah
    mov bh,video_page
    int 10h
    mov ah,10 ;then write a string of spaces

```

(Figure 1 continues)

```

mov al,32
mov cx,60
int 18h
ret
clear_input_line endp
;
;-----
;INITIALISE prepares the program for residency.
;-----
initialise proc near
;Determine what type of video adapter is installed.
;
mov ah,12h          ;prepare for call to int 10h
mov bl,10h          ;function = request EGA info
int 10h
cmp bl,10h
jbe int1
;BL=10h?
;yes, then no EGA installed
;BL=07
;no, then it's a monochrome system
int1:
dec adapter
mov ah,15
int 10h
cmp al,7
jbe int2
dec adapter
;
;Modify video parameter values for monochrome, then initialise the cursor.
int2:
sub video_segment,400h ;set VIDEO_SEGMENT for monochrome
mov border_attr,70h    ;change attributes for monochrome
mov text_attr,07h      ;set monochrome cursor definition
call show_cursor       ;set cursor to default mode
;
int3:
;Determine the port address of the CRT Controller and store it.
;
mov dx,40h            ;point DX to BIOS data segment
mov si,0
mov di,63h            ;point DI to address word
mov dx,esi[di]         ;get CRTC address
mov es,esi[di]         ;save it
;
;Get and save the address of the DOS BUSY_FLAG.
;
mov ah,34h            ;function 34h
int 21h               ;get address
mov dos_segment,esi    ;save segment
mov busy_flag,esi      ;save offset
;
;Save and replace all required interrupt vectors.
;
mov ah,75h            ;get interrupt 9 vector
mov si,9
int 21h
mov o109h,esi          ;save it
mov ah,25h            ;point it to KEYBOARD routine
lea dx,keyboard
int 21h
mov ah,35h            ;get interrupt 1Ch vector
mov si,1Ch
int 21h
mov o10Ch,esi          ;save it
mov ah,25h            ;then point it to TIMER
lea dx,timer
int 21h
mov ah,35h            ;get interrupt 13h vector
mov si,13h
int 21h
mov o103h,esi          ;save it
mov ah,25h            ;point it to HDISK
lea dx,hdisk
int 21h
mov ah,35h            ;get interrupt 28h vector
mov si,28h
int 21h
mov o102h,esi          ;save it
mov ah,25h            ;point it to BACKPROC
lea dx,backproc
int 21h
;
;Terminate but remain resident in memory.
;
mov dx,offset initialise+22h ;point DX to end of resident code
int 27h
;terminate-but-stay-resident
initialise
endp
code
endb
end begin

```

(Figure 1 ends)

lower are tenaciously avoided.

Memory-resident routines can utilize disk services and other DOS functions if the guidelines outlined above are followed. There are still a few times when such programs can't pop up, however. Use the DOS TYPE command to list a long file and try to bring up *SideKick* in the middle of the listing. You'll find that *SideKick* won't come up. The DOS Busy Flag is set the whole time and interrupt 28h is not executed, so a resident routine like *SideKick* that performs file I/O can't break in on the running TYPE command. The system isn't perfect, but it's the best that can be done until versions of DOS are developed that have real multi-tasking capabilities.

**INTERRUPTING POLITELY** In addition to guarding against violating DOS non-reentrancy characteristics, a memory-resident utility that accesses a disk must also be sure not to interfere with the applications program it is interrupting. Every application, resident or not, that reads disk information has to set aside some portion of memory (or use the default area DOS provides) to serve as a Disk Transfer Area, or DTA. Data brought in from the disk passes through this area on its way to the program that requested it. A resident program must define its own local DTA so that it doesn't overwrite data in the interrupted program's DTA. In addition, it must save the original DTA address and restore it before exit.

Another important but often overlooked consideration is what happens in the event of a critical error. A critical error is a special class of error that causes DOS to respond by generating an interrupt 24h. Control is shifted to the operating system's own handling routine. That's the routine that presents the infamous "Abort, retry, ignore?" message when the user tries to read from a drive without a disk in it. Any serious applications program written for PC-DOS that doesn't use a teletype-style interface must employ a custom critical error handler to prevent it from bombing in the event of an error condition, and the resident utility is certainly no exception. In fact, it's probably more important in resident code, because the crash of a resident routine would probably destroy the underlying program as well. A full-featured



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## ■ PROGRAMMING/UTILITIES

memory-resident program that performs file I/O must, therefore, point the interrupt 24h vector to its own routine on entry and then be sure to restore it to its original value on exit.

**INSIDE XDIR** As is usually the case, knowing the theory behind the method is a necessary, but not sufficient, condition for implementing it. There is a multitude of details to take care of, from how to coordinate simultaneous interrupt interceptions to how to make one resident program compatible with another. The best way to understand these, however, is to look inside a program that uses them, such as XDIR.

Like all resident utilities, XDIR begins by executing a section of code that sets the stage for the part of the program that will remain behind after termination. Once completed, the initialization code is effectively erased when the space it occupies is turned back over to DOS.

XDIR begins by determining what kind of video adapter is installed. This information is important because if a standard color/graphics adapter is being used, the program has to take special precautions when opening and closing the directory window. Writing directly to CGA video memory causes unsightly video snow unless memory modifications are undertaken only during one of the retrace cycles or the display is turned off altogether before the writing takes place. XDIR does the latter when it writes the window to the screen.

One popular way to detect the presence of an EGA video adapter is to check for the three letters "IBM" (even the non-IBM EGAs have them) in the EGA BIOS area. XDIR uses another method. The EGA BIOS includes additional functions above and beyond the normal BIOS video services available through interrupt 10h. One of these is function 12h. With the BL register set to 10h on entry, function 12h returns a 0 or a 1 in BL that indicates whether the EGA is in color mode (connected to a color RGB monitor) or monochrome mode (linked to a display like the IBM Monochrome Display). If there's no EGA in the system, however, a call to 12h simply returns the value of BL unaltered. XDIR uses that key, and if no EGA is present, then the current video mode number is used to determine whether a CGA or a

```

168 REM -- BASIC PROGRAM TO CREATE XDIR.COM
169 OPEN "XDIR.COM" AS #1 LEN = 1
170 FIELD #1 AS A$
171 CHECKSUM = 0
172 FOR J = 1 TO 161
173   LINE$ = 0
174   FOR I = 1 TO 8
175     READ BYTE
176     CHECKSUM = CHECKSUM + BYTE
177     LINE$ = LINE$ + BYTE
178   IF (BYTE < 256) THEN LIST AS = CHR$(BYTE)
179   PUT #1
180 NEXT J
210 READ LINECHECK
240 IF LINECHECK <> LINE$ THEN PRINT "Error in Line":200 + 16 * 1
250 NEXT I
260 CLOSE
270 IF CHECKSUM = 14461 THEN PRINT "Successful Completion" : END
280 PRINT "CON file is not valid!": END
290 DATA 211, 236, 6, 67, 113, 112, 121, 114, 296
300 DATA 185, 182, 184, 116, 32, 69, 37, 66, 622
310 DATA 54, 32, 80, 185, 182, 182, 65, 68, 598
320 DATA 97, 118, 185, 115, 13, 89, 137, 99, 762
330 DATA 188, 185, 115, 184, 189, 118, 183, 32, 762
340 DATA 67, 131, 46, 26, 92, 42, 46, 62, 672
350 DATA 0, 0, 0, 0, 0, 0, 0, 0, 0
360 DATA 2, 0, 184, 0, 79, 15, 0, 0, 280
370 DATA 0, 0, 0, 0, 0, 0, 0, 0, 0
380 DATA 0, 0, 0, 0, 0, 0, 0, 0, 0
390 DATA 0, 64, 0, 219, 5, 239, 11, 0, 558
400 DATA 0, 0, 0, 0, 0, 0, 0, 0, 0
410 DATA 0, 0, 0, 0, 0, 0, 0, 0, 0
420 DATA 0, 0, 0, 0, 0, 0, 0, 0, 44, 44
430 DATA 68, 45, 41, 42, 46, 38, 78, 111, 611
440 DATA 12, 78, 185, 188, 181, 115, 12, 78, 633
450 DATA 111, 117, 118, 188, 0, 251, 88, 228, 997
460 DATA 56, 68, 52, 117, 27, 188, 2, 285, 739
470 DATA 22, 169, 0, 116, 18, 232, 48, 2, 687
480 DATA 88, 46, 128, 62, 53, 1, 0, 117, 495
490 DATA 0, 189, 0, 195, 0, 1, 287, 528
500 DATA 88, 46, 255, 46, 87, 1, 156, 46, 725
510 DATA 255, 18, 93, 1, 46, 128, 62, 55, 668
520 DATA 1, 0, 134, 41, 6, 87, 46, 142, 419
530 DATA 6, 49, 1, 46, 139, 62, 51, 1, 355
540 DATA 38, 128, 61, 0, 95, 7, 117, 21, 467
550 DATA 46, 128, 62, 54, 1, 117, 0, 421
560 DATA 176, 32, 218, 32, 46, 190, 6, 55, 775
570 DATA 1, 0, 232, 53, 0, 287, 46, 254, 792
580 DATA 4, 6, 5, 156, 46, 287, 46, 683
590 DATA 1, 46, 254, 14, 54, 1, 287, 156, 733
600 DATA 46, 255, 38, 99, 1, 46, 128, 62, 467
610 DATA 4, 1, 0, 116, 0, 46, 128, 6, 421
620 DATA 55, 1, 0, 212, 11, 0, 287, 251, 757
630 DATA 46, 195, 4, 1, 176, 0, 3, 598
640 DATA 287, 46, 198, 6, 51, 2, 251, 763
650 DATA 88, 83, 81, 82, 86, 87, 18, 6, 515
660 DATA 16, 31, 16, 7, 188, 15, 285, 16, 482
670 DATA 68, 2, 116, 22, 68, 3, 116, 18, 197
680 DATA 48, 7, 116, 14, 198, 6, 51, 1, 455
690 DATA 0, 0, 31, 95, 94, 88, 1, 487
700 DATA 88, 195, 136, 62, 59, 1, 188, 3, 724
710 DATA 285, 16, 117, 14, 46, 1, 232, 131, 888
720 DATA 1, 1, 66, 1, 252, 128, 62, 55, 729
730 DATA 1, 1, 117, 3, 232, 68, 1, 232, 647
740 DATA 218, 0, 232, 153, 1, 128, 62, 56, 687
750 DATA 1, 1, 117, 3, 212, 59, 1, 232, 646
760 DATA 58, 2, 119, 62, 79, 1, 188, 18, 529
770 DATA 2, 277, 59, 218, 28, 1, 168, 27, 761
780 DATA 117, 3, 233, 114, 0, 81, 188, 1, 749
790 DATA 181, 32, 285, 16, 89, 188, 45, 1, 755
800 DATA 18, 89, 116, 38, 128, 128, 287, 9, 847
810 DATA 117, 1, 79, 143, 54, 44, 1, 185, 622
820 DATA 5, 0, 243, 164, 139, 22, 79, 1, 573
830 DATA 118, 78, 2, 198, 0, 78, 1, 232, 679
840 DATA 11, 281, 117, 21, 186, 11, 7, 141, 717
850 DATA 54, 116, 1, 232, 12, 232, 68, 988
860 DATA 1, 1, 1, 232, 254, 1, 232, 18, 1873
870 DATA 169, 212, 132, 2, 212, 3, 280, 869
880 DATA 0, 116, 12, 68, 27, 235, 245, 212, 578
890 DATA 248, 0, 212, 238, 2, 215, 147, 128, 1222
900 DATA 252, 81, 117, 18, 168, 78, 1, 58, 757
910 DATA 6, 1, 116, 22, 254, 6, 232, 1, 745
920 DATA 1, 232, 285, 2, 215, 212, 128, 252, 1286
930 DATA 71, 117, 289, 328, 62, 78, 1, 0, 688
940 DATA 116, 116, 254, 16, 78, 1, 232, 18, 1873
950 DATA 2, 215, 198, 212, 195, 1, 128, 62, 1845
960 DATA 56, 1, 1, 117, 1, 212, 111, 0, 543
970 DATA 212, 78, 0, 128, 62, 78, 1, 232, 1, 558
980 DATA 137, 3, 232, 113, 0, 188, 2, 118, 895
990 DATA 62, 59, 1, 119, 12, 3, 285, 55
1000 DATA 188, 188, 139, 14, 64, 1, 287, 628
1010 DATA 16, 233, 248, 254, 186, 0, 1, 138, 1885
1020 DATA 18, 56, 1, 18, 255, 18, 255, 1, 558
1030 DATA 177, 62, 62, 1, 119, 247, 18, 142, 838
1040 DATA 38, 57, 1, 46, 139, 62, 83, 1, 419
1050 DATA 185, 8, 82, 64, 64, 0, 247, 778
1060 DATA 165, 89, 113, 198, 32, 226, 244, 11, 1136
1070 DATA 195, 0, 139, 62, 62, 1, 142, 0, 613

```

(continues)

Figure 2: The BASIC program for creating XDIR.COM.

1000 DATA	57,	1,	239,	54,	81,	1,	185,	12,	532
1008 DATA	8,	105,	44,	9,	243,	165,	199,	627	
1016 DATA	111,	195,	32,	239,	243,	195,	176,	1319	
1112 DATA	168,	246,	238,	288,	226,	58,	246,	1,	1369
1120 DATA	196,	148,	196,	148,	196,	148,	196,	148,	196
1136 DATA	1,	249,	195,	186,	218,	3,	236,	168,	1257
1148 DATA	8,	116,	251,	131,	234,	2,	176,	37,	955
1156 DATA	238,	196,	148,	196,	148,	196,	148,	196,	148
1164 DATA	111,	1,	215,	186,	216,	3,	218,	195,	1255
1172 DATA	228,	97,	139,	234,	12,	128,	218,	97,	1154
1180 DATA	119,	196,	138,	97,	256,	176,	3,	231,	1569
1196 DATA	32,	251,	195,	188,	1,	139,	14,	73,	885
1208 DATA	1,	285,	19,	195,	139,	22,	75,	1,	654
1216 DATA	176,	14,	238,	46,	239,	138,	236,	74,	1036
1224 DATA	179,	15,	238,	46,	236,	37,	255,	7,	1038
1232 DATA	179,	88,	246,	243,	134,	226,	195,	188,	1481
1240 DATA	1,	285,	22,	117,	4,	285,	48,	235,	829
1256 DATA	246,	188,	8,	285,	22,	195,	6,	142,	996
1264 DATA	6,	57,	1,	139,	62,	62,	1,	176,	584
1272 DATA	218,	138,	18,	148,	1,	171,	185,	62,	873
1280 DATA	8,	174,	32,	243,	171,	176,	191,	171,	1168
1288 DATA	131,	199,	32,	185,	10,	7,	81,	176,	814
1296 DATA	179,	138,	38,	148,	1,	88,	171,	185,	852
1312 DATA	62,	8,	176,	32,	138,	38,	61,	1,	588
1320 DATA	243,	171,	88,	171,	131,	199,	32,	89,	1124
1328 DATA	238,	228,	176,	192,	171,	185,	62,	8,	1248
1344 DATA	179,	196,	243,	171,	176,	217,	171,	7,	1257
1352 DATA	185,	139,	14,	68,	1,	148,	2,	138,	724
1368 DATA	62,	59,	1,	285,	16,	232,	115,	255,	945
1376 DATA	58,	281,	222,	146,	255,	68,	13,	116,	1761
1384 DATA	116,	68,	37,	88,	138,	116,	58,	138,	515
1392 DATA	32,	68,	32,	114,	217,	58,	14,	68,	635
1408 DATA	1,	116,	211,	68,	211,	188,	18,	185,	884
1416 DATA	1,	1,	1,	1,	1,	1,	1,	1,	1
1424 DATA	285,	16,	89,	88,	178,	254,	193,	215,	1258
1432 DATA	289,	11,	261,	138,	196,	148,	282,	188,	1488
1440 DATA	188,	7,	285,	16,	188,	18,	176,	12,	881
1456 DATA	185,	1,	8,	285,	16,	89,	254,	281,	951
1464 DATA	75,	237,	183,	75,	237,	183,	75,	237,	183
1472 DATA	32,	148,	6,	181,	1,	117,	38,	185,	555
1480 DATA	1,	188,	26,	139,	22,	81,	1,	285,	655
1488 DATA	32,	53,	74,	61,	61,	61,	61,	61,	61
1496 DATA	9,	187,	1,	137,	38,	189,	1,	188,	571
1512 DATA	37,	141,	22,	15,	2,	285,	33,	7,	462
1520 DATA	196,	188,	37,	176,	38,	139,	32,	188,	989
1528 DATA	1,	38,	46,	142,	38,	187,	1,	285,	562
1544 DATA	32,	188,	26,	46,	139,	22,	185,	1,	552
1552 DATA	146,	38,	146,	38,	146,	38,	146,	38,	146
1560 DATA	195,	196,	6,	72,	1,	9,	188,	78,	738
1576 DATA	139,	1,	285,	77,	285,	139,	185,	8,	444
1584 DATA	8,	114,	61,	128,	62,	72,	1,	8,	438
1592 DATA	117,	54,	45,	139,	62,	85,	1,	232,	755
1600 DATA	17,	148,	79,	285,	139,	138,	128,	61,	914
1616 DATA	128,	62,	72,	8,	117,	19,	232,	622	
1624 DATA	31,	8,	45,	129,	249,	184,	1,	137,	696
1632 DATA	211,	137,	239,	13,	71,	38,	128,	61,	914
1640 DATA	8,	217,	249,	38,	254,	13,	119,	191,	1881
1656 DATA	72,	179,	48,	246,	243,	163,	69,	1,	1812
1664 DATA	195,	139,	54,	81,	131,	196,	1,	138,	829
1672 DATA	81,	185,	13,	8,	243,	164,	89,	195,	978
1680 DATA	188,	6,	72,	1,	8,	184,	9,	2,	478
1688 DATA	118,	38,	78,	188,	58,	255,	247,	217,	1818
1704 DATA	139,	248,	3,	54,	85,	1,	186,	18,	718
1712 DATA	188,	188,	18,	188,	188,	188,	188,	188,	188
1720 DATA	254,	198,	176,	18,	89,	128,	62,	71,	988
1736 DATA	1,	8,	117,	2,	226,	218,	195,	185,	964
1744 DATA	8,	61,	81,	82,	81,	82,	81,	82,	81
1752 DATA	98,	128,	194,	16,	94,	131,	199,	13,	864
1760 DATA	99,	128,	62,	71,	1,	9,	117,	2,	478
1776 DATA	228,	195,	128,	62,	138,	62,	58,	148,	1086
1784 DATA	1,	285,	19,	185,	1,	8,	172,	18,	598
1792 DATA	192,	116,	21,	98,	255,	116,	12,	188,	952
1800 DATA	18,	188,	188,	188,	188,	188,	188,	188,	188
1816 DATA	16,	235,	235,	199,	6,	71,	1,	763	
1824 DATA	195,	198,	6,	176,	8,	185,	14,	1,	755
1832 DATA	188,	188,	188,	188,	188,	188,	188,	188,	188
1848 DATA	16,	195,	188,	3,	189,	18,	2,	138,	724
1856 DATA	32,	185,	94,	8,	285,	39,	195,	188,	873
1864 DATA	188,	179,	19,	285,	19,	128,	251,	14,	299
1872 DATA	188,	179,	19,	285,	117,	171,	235,	188,	828
1880 DATA	144,	254,	14,	56,	1,	188,	15,	285,	868
1888 DATA	16,	68,	1,	117,	26,	254,	14,	56,	558
1896 DATA	1,	129,	46,	37,	1,	137,	8,	198,	888
1904 DATA	6,	68,	1,	112,	188,	6,	61,	1,	485
1920 DATA	7,	255,	6,	71,	1,	137,	192,	191,	1195
1928 DATA	149,	64,	1,	188,	6,	142,	188,	64,	844
1936 DATA	99,	8,	38,	139,	21,	137,	22,	75,	611
1944 DATA	188,	188,	188,	188,	188,	188,	188,	188,	188
1952 DATA	1,	137,	38,	51,	1,	188,	53,	176,	629
1960 DATA	9,	285,	11,	137,	38,	97,	2,	148,	642
1968 DATA	9,	285,	11,	137,	38,	97,	2,	148,	642
1976 DATA	1,	285,	33,	188,	53,	176,	28,	285,	881
1984 DATA	13,	137,	18,	91,	1,	148,	6,	93,	531
1992 DATA	238,	188,	37,	116,	22,	62,	285,	74,	1038
2000 DATA	33,	188,	53,	176,	19,	285,	33,	117,	816
2008 DATA	18,	185,	148,	6,	87,	1,	188,	588,	588
2016 DATA	188,	188,	188,	188,	188,	188,	188,	188,	188
2024 DATA	53,	176,	48,	285,	33,	137,	38,	99,	771
2032 DATA	1,	181,	6,	188,	188,	188,	188,	188,	188
2040 DATA	22,	247,	1,	285,	33,	186,	55,	38,	779
2048 DATA	295,	39,	9,	9,	9,	9,	9,	9,	9

(Figure 2 ends)

monochrome board is installed.

Next, the port address of the CRT Controller is obtained from the BIOS data area and stored away for later use. Then the undocumented DOS function 34h is called to let XDRI determine the address of the DOS Busy Flag. Why do it this early? We find ourselves in something of a catch-22 when we want to check the Busy Flag to see if the current ongoing process can be safely interrupted because if the PC is presently in the middle of servicing an interrupt 21h request, function 34h will crash the system. Therefore its address is saved during the nonresident phase, and the flag is accessed directly from inside the resident portion whenever XDRI needs to check it.

The final initialization step is to save and replace all of the interrupt vectors that XDRI will need. The program intercepts four interrupts (not including interrupt 24h, whose vector is manipulated when the directory window is called up—not during installation), each of which plays a vital role in orchestrating the pop-up process. The keyboard interrupt, interrupt 9, is borrowed so that XDRI can look for a press of the Alt-period trigger key combination. The timer interrupt and the background process interrupt (ICh and 28h, respectively) are used in a coordinated manner to process a request to pop up the window. The final interrupt that is intercepted, interrupt 13h, is used in a way that deserves comment.

Interrupt 13h provides all of the low-level BIOS diskette services for reading, writing, and formatting individual sectors and tracks. In a sense, these services are non-reentrant, just like the DOS interrupt 21h services, but for a different reason. There's no problem with stack locations; BIOS routines don't use an internal stack.

Instead, however, there is the omnipresent danger of interrupting the movement of the drive head from one track to another. If the resident routine performs any file I/O, the head will be moved from the position it was in when interrupted and will not be returned when the resident program passes control back to the application. XDRI intercepts interrupt 13h, maintains an internal flag (labeled FLAG\_13H in the source code) that reflects its status at any point in time, and doesn't let the window pop up if a BIOS disk service is in progress.

## ■ PROGRAMMING/UTILITIES

Finally the end of the initialization phase is reached, and XDIR executes an interrupt 27h to terminate but stay resident. An extra 6216 bytes are reserved beyond the end of the resident code to provide room for saving the screen contents before opening the window and for the text of the filenames read in from the disk. The DTA and pathname buffer are located in the 256-byte Program Segment Prefix, which is no longer needed after the program becomes resident. The net result is the sacrifice of a small portion of your computer's usable RAM but the gain of a very powerful and economical new utility.

Most memory-resident utilities, once installed, check every keypress looking for their specific trigger combination. In this respect, XDIR is no different: it intercepts the interrupt 9 that's generated every time a key is pressed or released and, if it detects a touch of the period key, immediately queries the system to see if the Alt key is also being held down. What it does when it finds the trigger keys depressed, however, is quite different from what a typical resident program does.

XDIR can't blindly take control of the computer and open the directory window ready for input; instead, it must make sure that it didn't interrupt a DOS service routine or a BIOS disk service. (If it did, it must wait until later to pop up.) Further, if the DOS Busy Flag is set, the routine must take advantage of an interrupt 28h if one is generated before the flag is cleared. It sounds somewhat formidable, but it really isn't. The XDIR keyboard handler doesn't even try to open the window, but merely sets an internal flag called REQUEST\_FLAG from 0 to 1 and promptly exits.

XDIR employs a pair of custom interrupt handlers for the express purpose of checking the REQUEST\_FLAG and, if possible, opening the directory window. The first is the procedure labeled TIMER, which is invoked 18 times every second at each tick of the time-of-day clock. TIMER checks the REQUEST\_FLAG and exits through an IRET if it's clear. But if the flag is set to 1, TIMER checks the DOS Busy Flag and FLAG\_13h, which indicates whether or not a BIOS disk service is in progress. If both are clear, TIMER calls the DIRECTORY procedure. DIRECTO-

## DOWNLOADING XDIR

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The modem number for PC-IRS is (212) 696-0360. Set your modem and communications software to use 1200 (or 300) bps, 8 data bits, 1 stop bit, no

parity. PC-IRS files with a .COM, .EXE, or .ARC extension require that you also use the Xmodem error-checking protocol; our other files (e.g., with extensions of .ASM or .BAS) can be downloaded using either regular ASCII or Xmodem transmission.

XDIR.BAS, whether typed in from the magazine at your keyboard or downloaded from PC-IRS, will automatically create XDIR.COM when run once in BASIC. XDIR.ASM, also listed both here and on PC-IRS, allows you to modify the program but requires you to use a macro assembler (IBM or Microsoft) and the commands:

```
MASM XDIR;
LINK XDIR;
EXE2BIN XDIR XDIR.COM
```

### XDIR at a Glance

Syntax: [d:][path]XDIR

Operation: XDIR is a memory-resident utility that displays the filenames (up to a maximum of 360) in any legal drive and directory from within a running applications program. Once loaded, either at the DOS command line or from within an AUTOEXEC.BAT file, pressing

Alt-

(Alt-period) opens a window that can hold up to 40 filenames. The desired

drive and/or path is then entered, and the PgUp and PgDn keys are used to display files in excess of the initial 40 listings. (To display the current directory it is not necessary to type in its path; pressing Enter will suffice.) Pressing Esc returns the cursor to the command line, and pressing it a second time closes the window and restores the contents of the interrupted applications program.

Because of its unusually thorough interrupt handling, XDIR is fully compatible with SideKick and with most other "difficult" TSR programs.

RY is the subroutine that actually opens the window, accepts input, displays directory listings, and closes the window on exit. If either flag is set, however, TIMER simply ends without doing anything, content to try again the next time it's called if REQUEST\_FLAG is still set.

The second routine complements the duties of the first. BACKPROC (for BACKGROUND PROCess) receives control any time an interrupt 28h is generated and, like the TIMER routine, checks to see if the directory window has been requested by looking at REQUEST\_FLAG. If the

flag is nonzero, BACKPROC examines FLAG\_13h and calls DIRECTORY if FLAG\_13h is clear. If FLAG\_13h isn't clear, an IRET is executed to end the interrupt. You can see how TIMER and BACKPROC coordinate their responsibilities: each routine checks the same REQUEST\_FLAG, and the first one that can answer a request to open the window does so, but only after clearing REQUEST\_FLAG so that the other won't try to duplicate the action.

The interrupt 28h handler doesn't have to check the DOS Busy Flag because, as

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## ■ PROGRAMMING/UTILITIES

was outlined at the beginning, most DOS function calls greater than number 0Ch can be safely called from within a 28h handling routine. Note here an interesting point: the DIRECTORY routine can be called from either an interrupt 1Ch or an interrupt 28h handler. We really don't care which one does it as long as the window pops up on the screen with minimal delay. The 28h routine can use only functions 0Ch and greater. The TIMER routine could safely use all DOS services because if it invokes the DIRECTORY subroutine, the Busy Flag must be clear. But since DIRECTORY doesn't know which handler will actually deliver control to it (and it could be different each time), it takes a conservative approach and avoids low-numbered DOS function calls altogether.

The DIRECTORY routine itself is the backbone of XDIR. When it is given control by either the TIMER or BACKPROC routine, it immediately sets the PROGRAM\_STATUS flag to 1 to void any subsequent press of the Alt-period combination. An STI instruction is executed to restore interrupts. Then it checks to make sure that the PC isn't presently in a graphics mode or a 40-column text mode. (Making the program work in video modes other than 80-column text modes would add significantly to the amount of overhead.)

A pair of video parameters has to be obtained and saved so they can be restored when the DIRECTORY routine is finished. The cursor mode is defined by the starting and ending scan lines that form the cursor and are reported directly by interrupt 10h, service 3. The same function call returns the cursor position as well, but that leads to a problem that crops up all too often and merits closer inspection.

**CUSTOM VIDEO DRIVERS** A handful of programs (e.g., Lotus's 1-2-3) bypass the BIOS video services built into the computer and instead use custom routines written especially for the IBM family of video adapters. They do this because BIOS routines are somewhat slow. These custom video drivers make life hard for a memory-resident routine designed to interrupt them without any destructive side effects because they typically don't keep the BIOS informed of details like the cursor's whereabouts. They move the cursor by writing

directly to the video adapter's CRT Controller (CRTC) rather than by invoking built-in routines that do the same. The result is that the video interrupt will erroneously report the cursor position to a routine making a request. This creates a sticky situation, one that can't always be overcome. But fortunately, at least when it comes to finding the correct cursor address, there is a solution.

The solution lies in obtaining the cursor address from the CRTC rather than from the BIOS. The routine CURSOR\_ADDRESS in the XDIR source code does just that. Both the Color/Graphics Adapter (CGA) and the Monochrome Display

## ■ XDIR buffers up to 360 names so that the list can be examined with the PgUp and PgDn keys.

Adapter (MDA) employ the Motorola 6845 CRTC, a small chip that allows a raster scan display to be driven in a variety of modes through a set of 18 internal and accessible registers. The EGA uses a custom CRTC that has some degree of compatibility with the 6845. In each of those adapters, the cursor address is stored in the form of a 16-bit video buffer address (similar to the PC's text mode character cell addressing scheme, but without the attribute bytes) that's held in registers 14 and 15 of the CRTC's internal array. Once the port address of the CRTC is obtained (that's why it was stored during initialization), the CRTC Address Register and Data Register can be manipulated to divulge the cursor address. CURSOR\_ADDRESS illustrates the mechanics of the process and the transformation of the buffer address to row and column format.

With vital cursor information stored away, DIRECTORY turns its attention to popping the directory window onto the screen. First the routine SAVE\_SCREEN is called to save the screen contents, then OPEN\_WINDOW writes the character/attribute pairs that define the window to vid-

eo memory. The video signal is disabled before the writing process begins if a CGA is being used and enabled again upon completion.

Next, LOSET is called upon to save the DTA address and interrupt 24h vector and to replace each with pointers to locations within XDIR. Both tasks are crucial to a resident program that accesses the disk if it's to be certain not to interfere with the application it interrupted.

When the window first makes its appearance on-screen, a flashing cursor sits poised on the top line awaiting input of a path string. The routine READLN is called to handle the receiving of input, and comes complete with its own routines to write characters and perform backspaces. Why create a custom input routine when DOS function 0Ah offers the same service? Because DOS functions numbered 0Ch and lower can't be used. Using it would be perfectly fine if the DIRECTORY routine was invoked from the TIMER module, but using 0Ah from within an interrupt 28h handler would be disastrous.

With an ASCII string in hand describing the path to the directory to be searched, DOS functions 4Eh and 4Fh are used to read the directory information. Both functions are well documented in the DOS *Technical Reference* and other texts. If the path string ends with a backslash character, XDIR appends the string \*. \* so that all filenames found will be reported. If it doesn't end with a backslash, the string \\*. \* is added. If nothing was entered on the input line, the global designator \*. \* is used so that the current directory is targeted. A search attribute of 0 is specified so that subdirectories, hidden and system files, and volume labels will be ignored. And rather than let the filenames scroll by, XDIR buffers up to 360 names so that the list can be examined backward and forward with the PgUp and PgDn keys.

After the first page of directory text is printed in the window, XDIR sits back and waits for a press of the Esc, PgUp, or PgDn key telling it what action to take next. Under normal circumstances BIOS interrupt 16h is used to trap a keypress. But these aren't normal circumstances. Any time XDIR solicits a keypress, it calls the GETKEY procedure instead of explicitly using the BIOS service. GETKEY does



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## ■ PROGRAMMING/UTILITIES

essentially the same thing as interrupt 16h and even employs it, but it also does something quite unique: it generates interrupt 28h over and over while it waits. The reason? For complete compatibility with other resident utilities like *SideKick*.

**KEEPING COMPATIBLE** To see why, try this short experiment. If you use another memory-resident utility from *PC Magazine* (my printer SETUP program, SETUP.COM, in Volume 5 Number 12 will do), install it into memory, and afterwards load *SideKick*. From the DOS command line, pop up *SideKick* followed by the other program. Both should work quite nicely. But then exit from both and, still from the DOS prompt, pop up the secondary utility followed by *SideKick*. You'll get a strange result. SETUP or the program like it will successfully come up, but *SideKick* will only respond with a series of audible chirps. That's *SideKick*'s signal that it can't pop up. The reason is that SETUP interrupted the execution of DOS function 0Ah, so *SideKick* looks at the DOS Busy Flag and realizes it can't take control until the flag clears or an interrupt 28h comes along. But the flag won't clear until SETUP hands control back to DOS, and SETUP doesn't generate an interrupt 28h. *SideKick* is helpless. *SideKick* might come up if this exact scenario were duplicated from within a running applications program rather than from the DOS command line, because chances are about even then that SETUP wouldn't have interrupted a DOS service in progress.

The situation is remedied by having XDIR generate its own interrupt 28h calls while it waits for a keypress. That way, a program like *SideKick* can pop up at any time, even if XDIR itself was invoked from an interrupt 28h. It's one of the little touches that make a program special, and it's a must if it's to claim true compatibility with other utilities on the market.

When the Esc key is pressed to close the window, several things occur. First, the original DTA address and the interrupt 24h vector are restored. Then the contents of the screen that was saved before the window was opened are written back to video memory. This effectively "closes" the window and reveals what lay beneath it. Finally, the cursor is set back to its original

location and unblanked, and the DIRECTORY routine ends by returning to the interrupt handler that called it. The handler in turn transfers control back to the program interrupted by the Alt-period keypress.

The only remaining item of interest is the critical error handler XDIR employs. The routine IOERR gets control when a critical error is detected. The most common such error is trying to read from an empty drive or damaged disk. The XDIR procedure GET\_DIR is the one that calls functions 4Eh and 4Fh to read the directory information, and is thus the one whose malfunction might result in an interrupt

### ■ XDIR generates its own interrupt 28h calls so a program like *SideKick* can pop up at any time.

24h. While a whole volume could be devoted to writing critical error handlers, IOERR is a very simple one that does its job in only a few lines of code.

When the operating system vectors to an interrupt 24h handler, a wealth of information is available to it describing what happened to cause the crisis. In addition, the stack contains the return address of the error routine, the register values at the time interrupt 21h was called, and the return address of the 21h code itself. IOERR simply sets an external flag called ERROR\_FLAG to 1 indicating an error has occurred, sets AL to 0 telling DOS to ignore the error, and passes control back to the operating system with an IRET. Control winds its way back to the instruction within XDIR (in the GET\_DIR routine) that follows the interrupt 21h call that went bad. GET\_DIR sees that ERROR\_FLAG is set and exits back to the main body of XDIR with CX set to 0, indicating that no files were found, and XDIR prints the "No files found" message.

Versions of DOS 3.0 and later provide a cleaner way to do the same thing. If AL is set to 3 when the user error handler ends

with an IRET, DOS fails the system call currently in progress. The traditional options, and the only ones available through DOS 2.10, are to abort the program, retry the operation, or ignore the critical error altogether. If DOS 3.x were a unanimous standard, XDIR's error handler could simply exit with AL set to 3 and not have to set an external flag. But it's not. Something of a double standard exists between 3.x and 2.x, so the programmer has to write code that will work on either.

**MODIFYING THE PROGRAM** No program is perfect for everyone. That simple axiom probably applies doubly where a resident utility is concerned, since it must walk a tightrope to avoid interfering with other programs like itself. The good news is that small modifications are easy to make when they're backed with the proper documentation. Armed with DEBUG, you can tailor XDIR for your own needs.

XDIR is brought to life by a press of Alt-period. If that conflicts with a piece of software you want to use, here's what to do: change the byte at offset address 018Ah to the scan code of the primary key you want to assign to bring up the window. Its present value is 52, the scan code for the period key. If you want to use Ctrl rather than Alt as the secondary key, change the byte at 0192h from 8 to 4.

As written, XDIR will display only normal filenames when it searches directories. Subdirectories, hidden files, system files, and volume labels are ignored. If that doesn't satisfy your needs, change the byte at offset 014Dh in the .COM file (it's currently set to 0 and labeled SEARCH\_ATTR in the source code) to the search attribute value you want, as outlined in the documentation for DOS function 4Eh. The following table lists each file type and the corresponding attribute value:

Hidden	2
System	4
Subdirectory	16

Setting the search attribute byte to 16, for example, will tell XDIR to display subdirectory names as well as filenames. The values listed above are additive, so setting the byte to 18 would result in hidden files, subdirectories, and normal files being listed. The DOS Technical Reference men-

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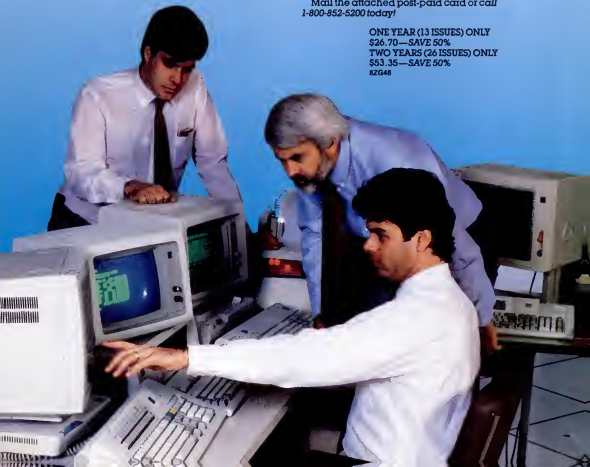
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## ■ PROGRAMMING

tions a volume label bit in addition to the rest. Don't set it. A search that includes volume labels as a target will automatically ignore everything else.

If you have a color system and don't like the program's default color scheme (a red border with white text printed against a black background), this, too, is easy to modify. Change the byte at 013Ch to the desired border attribute and the byte at 013Dh to the new text attribute. They appear in the source listing as the bytes `BORDER_ATTR` and `TEXT_ATTR`. All of this has no effect in monochrome.

**IN CLOSING** The PC-DOS operating system provides applications programmers with some of the most sophisticated coding tools available. Its built-in routines are nothing short of crucial for a program that must communicate with disk media. Learning how to deploy non-reentrant DOS routines from inside a resident utility is no picnic because there is precious little material on the subject, yet it's one of the more useful skills a programmer can learn. It's as if that knowledge were a deep dark secret that can't be trusted in the hands of the average user. Microsoft continues to foster that notion by withholding documentation on DOS function 34h and a host of other useful services. In reality, there's nothing hard about it. Just follow a few simple rules and it's a cookbook process.

I hope this article sheds some light on an interesting but elusive subject. Utilities like XDRI are fascinating and deserve their own little niche in your library. With major software companies like Borland and Microsoft collaborating on establishing standards for the structure and behavior of memory-resident programs [aided, we hope, by such independents as the Ringmaster team—Ed.], the days of utilities that won't work with each other and can't be uninstalled from memory should be nearing an end. But even with the acceptance of new interfaces like *Windows*, don't write gems like *SideKick* off too soon. Just as there will always be room for improvement in any operating system, there will always be programmers waiting to plug the holes.

*Jeff Prossie* is a frequent contributor to PC Magazine.



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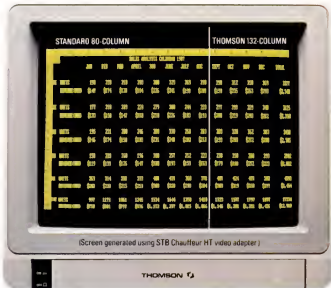
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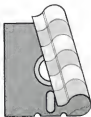
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■ JARED TAYLOR

# SPREADSHEET CLINIC



*Importing mixed text and numbers in Release 1 of 1-2-3; ignoring columns when printing; your cursor as bathysphere; more on displaying column letters.*

## SKIP COLUMNS WHEN PRINTING

When printing a report in 1-2-3, have you ever wanted to skip over one or more columns of data without changing your worksheet? It's easy: just use the borders option of the /Print command.

In the example shown in Figure 1, the top chart is your original worksheet, and the smaller chart below it is all you want to print. By defining cells C3 to F14 as a column border, you ensure that that part of the worksheet is printed in the leftmost columns. By then defining cells M3 to N14 as the regular print range, you force 1-2-3 to skip columns G through L when it prints.

The macro, /P, contains the commands to set up both the border columns and the regular print range. At the keyboard, the actual command sequence for setting up borders would be /Print Printer Options Borders Columns.

This technique works for all versions of 1-2-3. Also, if you want to skip rows instead of columns when you print, you can use the Options Borders Rows sequence.

Debbie Lee-Cassimus

*A new trick for an old dog.*

## FINDING THE COLUMN LETTER

In the Spreadsheet Clinic of November 11, 1986 (Volume 5 Number 19), you proposed several ways to find the column letter of a cell address in 1-2-3. You can do this more easily with the @char function than with a lookup table containing the alphabet.

The formula in cell D8 of Figure 2 is all you need. It adds 64 to the number re-

	C	D	E	F	G	H	I	J	K	L	M	N
4												
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6	BARNETT, MIKE	E		\$5,000.00		\$2,500.00		\$4,000.00		\$11,500.00		
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9	CASSIMUS, DAVID	E		\$3,000.00		\$4,000.00		\$2,000.00		\$9,000.00		
10	LEE, MARK	A		\$2,000.00		\$2,500.00		\$2,000.00		\$7,500.00		
11	LEONARD, LARRY	D		\$5,000.00		\$3,000.00		\$6,000.00		\$14,000.00		
12	MILLER, PENNY	D		\$2,000.00		\$5,000.00		\$2,000.00		\$9,000.00		
13												
14												

	SALESMAN	DEPT	QUARTERLY TOTAL
6	BARNETT, MIKE	E	\$11,500.00
7	BROOKS, SHEILA	A	\$6,000.00
8	CASH, RANDY	C	\$19,000.00
9	CASSIMUS, DAVID	E	\$9,000.00
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11	LEONARD, LARRY	D	\$14,000.00
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Macro that prints only these columns:  
/P /ppboc3..F14"qM0.N14"agg

Figure 1: A 1-2-3 macro (/P) that allows you to print only selected columns (shown in the lower part of the figure) from the wider spreadsheet (shown in the upper part).

	C	D	E
3	CELL		
4	-----		
5	CONTENTS	CELL	Contents of current cell.
6	POSITION	C3	Address of current cell.
7	ROW	3	Row number of current cell.
8	COLUMN	C	Column letter of current cell.
9			
10	CONTENTS 2	CELL	Contents of current cell.
11			
* * * * *			
FORMULAS:			
CONTENTS	=D6		
POSITION	=D8&STRING(D7,0)		
ROW	=CELL.POINTER("row")		
COLUMN	=CHAR(64+CELL.POINTER("col"))		
CONTENTS 2	=IF(CHAR(64+CELL.POINTER("col"))&STRING(CELL.POINTER("row"),0))		

Figure 2: Several different ways to use @char in finding the column letter of the current cell.

## ■ SPREADSHEET CLINIC

turned by the @cell pointer function so as to produce the proper LICS code and display a letter. The only drawback to this scheme is that after the letter Z there is obviously no LICS code for AA, AB, etc., and you will get incorrect results. However, more often than not, 26 columns may be all you need in a worksheet, so you won't have to go past Z.

The other formulas in the figure are elaborations on the one in D8. D6 simply combines the information in D7 and D8 to

## ■ You can find the column letter of a cell address more easily with the @char function than with a lookup table containing the alphabet.

return both the row number and the column letter. D5 uses @a to return the contents. Finally, the formula in D10 combines all these functions to return the contents of the current cell by first establishing its address.

Michael J. Hillier  
Columbus, Missouri

*The technique used in cell D8 is rough and ready, and Mr. Hillier is candid about its limitations. Although a lot of models will fit into columns A to Z, a lot won't. (See next submission for a trick that works past column AA.)*

*The formula in D10 is an interesting exercise, but if you just wanted to return the contents of the current cell you would more naturally use @a cellpointer("contents").*

### MORE ON COLUMN LETTERS

The first formula in Figure 3 displays the column letter of any cell that contains the formula. It will work in any part of the spreadsheet and is not limited to the cells in columns A to Z.

Todd Barringer  
Kirkland, Washington

```
@MID(CCELL("ADDRESS",A$1..A$1),1,8)IF(CCELL("COL",A$1..A$1)<=26,1,2))
@MID(CCELLPOINTER("ADDRESS"),1,8)IF(CCELLPOINTER("COL")<=26,1,2))
```

Figure 3: A formula that returns the column letter of the cell containing the formula (top) and of the current cell (bottom).

This is a clever use of the @mid function to get around the fact that 1-2-3 displays the address of a cell but not the column letter alone.

@cell("address",A\$1..A\$1) by itself would display both the column letter and the row number. Since you want only the column letter, the formula uses @mid to truncate the display. The @if function tests to see if the column number (remember, it's a number, not the column letter) is less than or equal to 26—that is, if it's A to Z. If it is, the formula displays only the first letter of the address; if it's greater than 26 (AA and beyond), it displays the first two characters of the address.

I liked this formula so much that I knocked out a version that works with @a cellpointer, which solves the one problem in the previous item. I have included this in Figure 3, as well.

### GETTING TO THE BOTTOM

I read with interest the submission to Spreadsheet Clinic of October 28, 1986 (Volume 5 Number 18) that showed how

to send the cursor to the bottom of a column even when there are blanks in the column. (The usual {end}{down} method will stop at the first blank cell.) It used a macro to bounce the cursor off row 8192 and then back to the first nonblank cell.

As shown in Figure 4, I have refined the macro slightly so that it will work in whatever column the cursor is in. The formula in the cell named BOTCOL takes the first three characters of @a cellpointer("address") and adds 8192 to complete the {goto} command.

James R. Hunter  
Los Angeles, California

### IMPORTING TEXT AND NUMBERS

It's sometimes necessary to import text files into 1-2-3. Often these files are produced by other programs and contain mixed data with both text and numbers.

Unless the data has been properly prepared with quotation mark delimiters, the /File Import Numbers command will leave out text. /File Import Text will import all the data, but as labels that can be up to 240

```
\B      {recalc BOTCOL}
BOTCOL  {goto}
        $A$8192
        {end}{up}

Formula for BOTCOL:
=ELEFT(@CELLPOINTER("address"),3)&"8192"
```

Figure 4: A macro that sends the cursor to the bottom of the current column.

	A	B	C	D	E	F	G	H	I
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									

Figure 5: An alternative to the Release 2.0 method of parsing mixed data in 1-2-3.

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\* Quicken's Transfer is included on the Apple program disk. The IBM version comes on a separate disk costing \$15.

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## ■ SPREADSHEET CLINIC

characters long. This is not a convenient format for manipulating data. You can write macros that break up the data into separate columns, but Figure 5 demonstrates a method that uses 1-2-3's string functions to do the same job.

First, import your data as a text file, in a part of the spreadsheet adjacent to where you actually want the data. In Figure 5, cell F1 contains a sample line of mixed text and numbers, imported as a long label. In a real example there would be many lines of data in the same format. You actually want this data not in column F, but in columns A through E. You want the numbers to be values and the text to be text.

Adjust columns A through E to the proper width for the data. Then enter the @mid formulas in A1 to E1, as indicated in the figure. Each formula indicates which part of the label in F1 should be extracted and displayed. Where you want numbers, as in cells A1 and E1, use the

@value function. The @trim function is not always necessary, but it will clean up misaligned character positions by eliminating leading and trailing spaces.

### ■ It's sometimes necessary to import text files that contain both text and numbers.

Once you've entered the first row of formulas, copy it down to as many rows as you have rows of data. You can then use the /Range Value command to change the formulas into actual values. Your data is now fit for use in a spreadsheet.

Although this isn't exactly an elegant

solution to the problem, it does work.

Peter Hendel  
Alpharetta, Georgia

*No, it's not elegant. Release 2.0 of 1-2-3 has a /Data Parse command that does the same job, but it's not elegant either. I think Mr. Hendel's method is certainly no slower than /Data Parse, and it has the advantage of being completely under the control of the user.*

### CONTRIBUTE TO THE CLINIC

Share your latest spreadsheet discovery through PC Magazine's Spreadsheet Clinic. We'll pay you \$50 for anything we print, plus an extra \$25 if you submit it on a disk. If you send a disk, please include a printout. Mail your contributions to Spreadsheet Clinic, PC Magazine, One Park Avenue, New York, NY 10016. Do not use MCI Mail, however, since code is often mangled in transmission.

## Laptop Users: "This thing is fabulous"

John C. Dvorak\*

We couldn't agree more with John Dvorak, and couldn't have said it better: "Buy the Brooklyn Bridge from White Crane Systems.... It's a combination cable and software package that hooks the Toshiba or Zenith (and other MS-DOS laptops) to your PC, XT or AT via the serial port and allows you full access to all the disk drives of both machines for effortless file transfer (at 115K bits per second).... Installation is a snap. It works first time out, no glitches. It's transparent. It's great. And since it's priced at \$129.95, it would be silly to buy an add-on drive for your MS-DOS laptop.

"Call the company at (404)454-7911 or write them at White Crane Systems, 6889 Peachtree Industrial Boulevard (Suite 151), Norcross, GA 30092. My highest recommendation."

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*EasyLAN* shares printers and disk drives between IBM PCs. *EasyLAN* can save you \$1,000 or more per PC by eliminating duplicate equipment purchases.

And now, you can run NETBIOS supported applications. Or you can write your own network applications for *EasyLAN* and other NETBIOS compatible networks.

#### *EasyLAN* VERSION 3.0 HIGHLIGHTS

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- Supports up to 18 PCs or compatibles
- New Network Commands
- New NETBIOS
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- PBX support
- Easy to install
- Easy to operate
- Modern support
- Performs in the background

*EasyLAN*'s low price matches the small business user's cost-sensitive budget. It is the office network solution for less than \$100 per PC.

*EasyLAN* performs its operations concurrently in the background. *EasyLAN* communications, file transfers and printer operations all take place while each PC simultaneously performs such normal DOS applications as Lotus 1 2 3™, Wordstar™, and dBASE™.

#### NEW NETBIOS SUPPORT—WRITE YOUR OWN COMMUNICATIONS PROGRAMS.

Programmers may use *EasyLAN* to develop network applications using NETBIOS (interrupt 5c). These applications can now be operated across the low cost RS 232 communications links used by *EasyLAN*. Our new *EasyCALENDAR* program is an example of a network application that uses NETBIOS for program to program communications.

Multi user data base management applications that require a high overhead network operating system will perform faster on high cost networks operating at mega bit speeds.

#### NEW VERSION 3.0 COMMANDS EXPAND NETWORK FLEXIBILITY

EZCLOCK lets PC's attached to the network read the time and date from a single master clock on the central PC, eliminating the need to install individual clock boards on each PC and insuring that all file entries and updates made across the network are dated.

The EZ Make Directory and EZ Remove Directory commands function identically to the DOS MKDIR and RMDIR commands, and give remote users increased flexibility when it comes to managing subdirectories on the central PC.

EZBEEP lets you send an audible signal across the network alerting a PC user that a file or message is being sent.

#### *EasyLAN* PBX SUPPORT BRINGS NEW FLEXIBILITY TO PC CONNECTIVITY

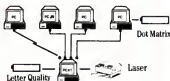
With *EasyLAN*'s PBX support, users can share peripheral and transfer files using PBX switched circuit connections and existing twisted pair wiring. *EasyLAN* has already been installed on a number of different PBX's, and recently was certified by Northern Telecom for use on its Northern SL 1.

# EasyLAN—Networking With Netbios Support. And it's Only \$99.95 Per PC.

The value is high  —InfoWorld Report Card

Disk sharing uses *EasyLAN*'s EZCOPY command to move files to and from PC's ASCII or binary files can be transferred in the foreground, or in the background while other DOS programs run.

Printer sharing operates transparently with existing programs. Print files are automatically spooled to disk and scheduled for printing. Multiple printers on the central PC may be designated for individual printing tasks.



*EasyLAN* Office Network

#### *EasyLAN* SPECIFICATIONS

Each PC in the network requires an individual licensed copy of the *EasyLAN* program and takes 20k of memory on each satellite PC, a serial port, and DOS 2.0 or above. *EasyLAN* runs on all IBM PC models and compatibles. The central PC requires a serial port for each satellite PC. The COM2 and COM6 boards are serial port expansion boards which permit you to add serial ports to the central PC.

#### EASY TO INSTALL

*EasyLAN* can be installed in less time than it takes to enjoy your coffee break. Just plug the *EasyLAN* cables into existing serial ports. The *EasyLAN* Network Configuration Program provides menu driven installation program that will guide you step by step through the software installation process.

#### *EasyCALENDAR*—USE YOUR NETWORK TO SCHEDULE MEETINGS.

The first of a new series of *Easy* network application products using NETBIOS is now available. *EasyCALENDAR* handles time management applications for individuals or a department and can be run on personal computers attached to any NETBIOS compatible network.

##### Highlights:

**CALENDAR MANAGEMENT** for individuals and the work group

**TASK MANAGEMENT** to create, maintain and review to do lists

**TODAY'S NEWS** for broadcasting messages, notices or announcements across the network

**MENU INTERFACE** for ease set up and use

*EasyCALENDAR*'s data base for appointments, to do lists and news resides on the central PC. Satellite PCs all fetched through *EasyLAN* version 3.0 send network transactions to the central data base to invoke *EasyCALENDAR* functions

The *EasyCALENDAR* calendaring program requires *EasyLAN* version 3.0 and is priced separately.

*EasyCALENDAR* will be available March 1987. Adv. price orders are being accepted now.

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Item	Description	Price	Qty	Amount
EL 02	<i>EasyLAN</i> Kit—for 2 PCs 30' cable, two disks & manuals	\$219.95	_____	\$ _____
EL 03	<i>EasyLAN</i> Expansion Kit—for 1 PC 30' cable, one disk & manual	\$119.95	_____	\$ _____
EL 10	<i>EasyLAN</i> disk & manual (30' disk \$89.95)	\$ 89.95	_____	\$ _____
EL 12	<i>EasyLAN</i> 90' cable	\$ 49.95	_____	\$ _____
EL 13	COM2 serial port expansion board, two ports	\$219.95	_____	\$ _____
EL 14	COM6 serial port expansion board, six ports	\$499.95	_____	\$ _____
EC 01	<i>EasyCALENDAR</i> Kit Supports 6 PC's and 10 people	\$199.95	_____	\$ _____
EL 15	Custom length cables, call for quote			
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- Supports manual change or list
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- Prints invoice material if needed
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- Prints sales journals
- Allows return credit memos
- Interface with General Ledger, Accounts Receivable & Inventory

### ACCOUNTS PAYABLE

- Can post to 200 general ledger expense accounts per module
- Automatically updates inventory and general ledger daily
- Automatically prepares payments
- Supports partial payments and handwritten checks
- Supports prepaid expenses and future liabilities
- Processes credits and debit memos
- Computes discounts and records discounts taken

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- Generates automatic payroll
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# CONNECTIVITY CLINIC



*Equal time for non-IBM micro-to-mainframe connections, a lesson in TCP/IP, and proof that charity begins at home.*

## NONBLUE SOLUTIONS

The micro-to-mainframe articles in *PC Magazine* are informative, but you assume that everybody wants to communicate with host computers using the IBM SNA, SDLC, or Bisync standards. How about some information on linking IBM-standard PCs to the Sperry and DEC computers we already use?

*Some excellent products allow your IBM-standard PC to speak Sperry and DEC. PC Connectivity Labs has looked at two of them, and, while we don't have complete benchmark reports, they both seem to work well with their respective host systems.*

Chi Corp. in Cleveland, Ohio, markets the Chi UTS Emulator, which fits into a PC and lets it communicate with Sperry mainframes set up for the Sperry UTS-20, 30, 40, 60, 400, U100, and U200 series terminals. For \$745 you get an interface board, emulation software, and a keyboard overlay. Chi has sold thousands of these interfaces to Sperry's biggest customer, the Federal Government. Call Chi at (216) 831-2622 for more information.

There is more to establishing communications with a DEC computer than emulating a VT-102 terminal. Polygon's products let PC users store and share their data and program files on a VAX. Their PolyShare software runs on DEC's ranging from the MicroVAX through the VAX 8600. It is priced between \$995 and \$2,795, depending on hardware configuration. The \$300 poly-Star and poly-COM/240 packages for the PC emulate all

of the DEC terminals and work with PolyShare to perform error-free file transfers. In effect, the Polygon software system makes the VAX a server for an MS-DOS LAN with a star topology. Call Polygon at (314) 576-7709 for more information.

## SHOEMAKER'S CHILDREN

We are relocating our offices and think this would be a good time to introduce a network, mainly for file exchanges. Bill Machrone says there is already enough twisted-pair wiring in the walls and he doesn't want to put in coax. Given those specifications, what do you recommend?

Bill Howard  
Executive Editor  
PC Magazine

*Bill, since you specify that you mostly want to exchange files, I would first ask you if you are also ready to upgrade your telephone system. A digital PBX like the latest*

*version of the Mitel SX-200 can be a fine avenue for swapping files over twisted-pair wiring. Since I happen to know that you have a relatively new telephone PBX that is not capable of digital transmission, it looks like a media-sharing LAN is in order. I think you have overlooked or underestimated the value you will get from a LAN by using electronic mail and multi-user DBMS applications such as a shared database of editorial contacts.*

*My first choice for a network in an office like yours would be Fox Research's 10-NET. The wiring is simple and inexpensive and the network works well on standard telephone wires. The 10-NET software stays out of the way and doesn't use RAM on the PC when it isn't needed. However, I hesitate to put 10-NET into the PC Magazine editorial offices because it is not yet NETBIOS compatible. I don't want to be in the line of fire when the latest networked communications package won't work on the PC Magazine Editorial LAN because the LAN isn't NETBIOS compatible.*

*Given the twisted-pair wiring limitation, I must recommend the StarLAN standard for the network interface cards. You can buy StarLAN boards from AT&T, Western Digital, Hewlett-Packard, and other vendors. Selecting the StarLAN system will mean that you have to install a \$750 wiring hub, but since the existing telephone cables already go back to a central point at the PBX or a wiring closet, this shouldn't be too much of a problem. Be warned, however: if you don't have a spare two-pair going from every office to a central point, you'll wind up pulling cable*

■ Some excellent products let your IBM-standard PC speak Sperry and DEC. They work well with their respective host systems.

## ■ CONNECTIVITY CLINIC

anyway, which may put you into the same price bracket as running coax.

AT&T Information Systems' StarLAN Network Program software is slow and has few other redeeming features. The

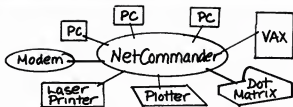
choice of networking software for a StarLAN network really is between Novell's Advanced NetWare and IBM's PC Local Area Network Program. Both programs will run on the StarLAN boards if the ven-

dor of the network interface boards provides a standard NETBIOS program.

Novell's Advanced NetWare requires that one computer be dedicated to acting as a server. The IBM PC LAN software lets any machine on the network contribute resources such as a disk drive or printer to the network. It is easier to install than Novell's NetWare, but lacks some of its features.

My personal opinion is that workstation resource-sharing is not extremely valuable in most office installations. It sounds good at first, but it has many practical limitations. What do you do when someone's machine that you want a file from is not

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■ If you are ready to upgrade your telephone system, a digital PBX can be a fine avenue for swapping files over twisted-pair wiring.

turned on? Do you break into their office, fumble with their diskettes, and boot their system? I think it is easier and safer to put the files to be shared on a central server. This same server can provide you with electronic mail and shared databases when you decide (as you will in a matter of days) that you need them.

## SHARE YOUR NETWORKING SECRETS

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12

## The Product Market

### Physical Attributes of Market

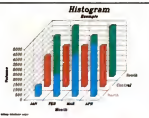
- Size of market
- Geographic location
- Demographic description of purchasers

### Behavioral Characteristics of Purchasers

- When purchases are made
- How buying is done
- Purchasing intentions

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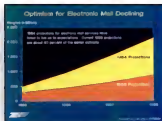
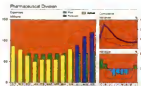
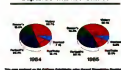


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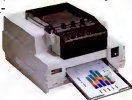
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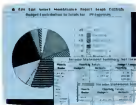
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■ NEIL J. RUBENKING

# TURBO POWER USER



*Adding COPY, DELETE, and ERASE to Turbo Pascal; finding out if Washington crossed the Delaware on a Thursday; giving Turbo standard Pascal's get and file pointer functions.*

## DOSTURBO

I often find it annoying that you can't run DOS programs—especially DELETE, COPY, and APPEND—from the Turbo Pascal editor. I have written the short programs shown in Figures 1, 2, and 3 to duplicate these utilities, which I keep on my Turbo disk.

To use one of these programs, you read it into the top of your current program file with Ctrl-KR ('KR'). You can then run it without having to comment out your file because the compiler ignores everything after an "END". And since the small program arrives already marked as a block, you can quickly delete it with Ctrl-KY ('KY'). This is much faster than saving your file, exiting to DOS, performing the DOS function, reentering Turbo, and reloading your program.

David A. Johns  
Gainesville, Florida

The program to DELETE a file (Figure 1) will work on any file, but those programs to COPY or APPEND one file to another (Figures 2 and 3) work only on text files. I've constructed my own program to copy any file, whether it is text or not, which is shown as Figure 4.

Turbo 3.01A has a minor bug in its append procedure. If you try to append to a totally empty file, your program will crash. The procedure OpenForAppend is a workaround to protect you from this sort of crash.

The file copy program that is listed in Figure 4 demonstrates two Turbo features for untyped files that are not in the manual,

```
PROGRAM Delete;
VAR
  FileVer : FILE;
  Name    : STRING[255];
BEGIN
  Write('Delete file: '); ReadLn(Name);
  Assign(FileVer, Name);
  Erase(FileVer);
END.
```

Figure 1: A program to delete any file without leaving the Turbo editor.

```
PROGRAM Copy;
VAR
  Source, Deet : Text;
  Name, Line   : STRING[255];
BEGIN
  Write('Copy from TEXT file: '); ReadLn(Name);
  Assign(Source, Name);
  Write('          To: '); ReadLn(Name);
  Assign(Deet, Name);
  Reset(Source); Rewrite(Deet);
  WHILE NOT Eof(Source) DO
  BEGIN
    ReadLn(Source, Line);
    WriteLn(Deet, Line);
  END;
  Close(Source); Close(Deet);
END.
```

Figure 2: A program to copy a text file without leaving the Turbo editor.

```
PROGRAM Append;
TYPE
  etring255 = STRING[255];
VAR
  Source, Deet : Text;
  Name, Line   : etring255;

PROCEDURE OpenForAppend(VAR F : Text; FName : etring255);
BEGIN
  Assign(F, FName);
  [SI] Reset(F); [SI+]
  IF IOResult <> 0 THEN Rewrite(F)
  ELSE
    IF Eof(F) THEN
      BEGIN
        Close(F); Rewrite(F) END
      ELSE
```

(continues)

Figure 3: A program to append a text file without leaving the Turbo editor.



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## PRODUCTIVITY

### ■ TURBO POWER USER

```
BEGIN Close(F); Append(F) END;

END;

BEGIN
  Write('Append from TEXT file: '); ReadLn(Name);
  Assign(Source, Name);
  Write('          To: '); ReadLn(Name);
  Assign(Dest, Name);
  Reset(Source);
  OpenForAppend(Dest, Name);
  WHILE NOT Eof(Source) DO
    BEGIN
      ReadLn(Source, Line);
      WriteLn(Dest, Line);
    END;
  Close(Source); Close(Dest);
END.
```

(Figure 3 ends)

```
PROGRAM CopyAnyFile;
VAR
  Source, Dest : FILE;
  Name        : STRING[64];
  Buffer       : ARRAY[1..16384] OF Byte;
  RecsRead    : Integer;
BEGIN
  Write('COPY from: '); ReadLn(Name);
  Assign(Source, Name);
  Write('          To: '); ReadLn(Name);
  Assign(Dest, Name);
  (* Note 2nd parameter in Reset and Rewrite of UNtyped files *)
  Reset(Source, 1); Rewrite(Dest, 1);
  WHILE NOT Eof(Source) DO
    BEGIN
      (* Note 4th parameter in BlockRead *)
      BlockRead(Source, Buffer, 16384, RecsRead);
      BlockWrite(Dest, Buffer, RecsRead);
    END;
  Close(Source); Close(Dest);
END.
```

Figure 4: This program will copy any file without leaving the Turbo editor.

though they are described in the *READ.ME* file. First, *Reset* and *Rewrite* can take an optional second parameter that defines the block size for *BlockRead* and *BlockWrite*. Second, *BlockRead* and *BlockWrite* can take an optional fourth parameter that returns the actual number of blocks read or written. Setting the block size down to 1 byte, as this program does, will not slow down the execution as long as you read many blocks each time. In this case, the program is set to ask for 16,384 bytes with each *BlockRead*, but will *BlockWrite* only the actual number of bytes read.

#### MISSING TURBO FUNCTIONS

One irksome omission in Turbo Pascal is the lack of the standard Pascal routines *get(f)* and *f^* (file pointer). Many Pascal programs use these routines, and converting such programs to Turbo can be quite difficult. The listing in Figure 5 is my solution to this problem.

*File\_ptr* is a function of type *char*. It calls *EOF*, which forces a read of one character from the file into the character buffer, to see if the next character is a "Z". The Turbo file pointer does not move, but the character buffer now holds the next character, just like a standard Pascal file pointer. *File\_ptr* simply returns the contents of this buffer.

The type *text\_info* matches the first four bytes of a Turbo text file variable. The fourth byte is the character buffer. Defining a variable of type *text\_info* at the same absolute location as the text variable *f* makes it very easy to ensure you always get the right byte.

Barry Fortune  
Johannesburg, South Africa

The two routines shown in Figure 5 will be a boon to anyone who must convert to Turbo Pascal from standard Pascal. Turbo Pascal packs a lot of information into the File Interface Block. I've added a small

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## ■ TURBO POWER USER

```

PROGRAM File_Pointer;
VAR
  T : text;
  Name : string[64];

FUNCTION File_Ptr (VAR F : text); CHAR;
TYPE
  text_info = RECORD
    handle : integer;
    flags : byte;
    char_buffer : char;
  END;

VAR
  pseudo : text_info absolute F;
BEGIN
  IF Eof(F) THEN BEGIN WriteLn($'Reading past EOF!'); Halt; END;
  File_Ptr := pseudo.char_buffer;
END;

PROCEDURE get (VAR F : text);
VAR Ch : char;
BEGIN
  IF Eoln(F) THEN readLn(F) ELSE read(F, Ch);
END;

BEGIN
  Write('Enter the file name: '); ReadLn(Name);
  Assign(T, Name); reset(T);
  WHILE NOT Eof(T) DO
    BEGIN
      IF Eoln(T) THEN writeln
      ELSE Write(File_Ptr(T)); (* "write t," in standard Pascal *)
      Get(T);
    END;
  END.

```

Figure 5: An implementation of "get" and file pointer for Turbo Pascal.

```

PROGRAM file_info; (* FILEINFO.PAS *)
TYPE
  Flag_Set = SET OF (b0, b1, b2, b3, b4, Char_Waiting, Out_Okay, In_Okay);
  fancy_FIB = RECORD
    handle : integer;
    F : RECORD
      CASE Boolean OF
        True : (ftype : byte);
        False : (flags : flag_Set);
      END;
    chBuff : Char;
    R_Offs : integer;
    R_Size : integer;
    R_Ptr : integer;
    R_End : integer;
    path : ARRAY[0..63] OF Char;
  END;

VAR
  TF1 : Text;
  TF2 : Text[32]; (* specifies a file buffer of 32 bytes *)
  TF3 : Text;

PROCEDURE File_Report (VAR F);
VAR
  FIB : fancy_FIB absolute F;
  N : byte;
BEGIN
  WITH FIB DO
    BEGIN
      CASE (F.ftype AND $F) OF
        $ : BEGIN
          Write('Disk file: ');
          IF (Out_Okay IN F.Flags) OR (In_Okay IN F.Flags) THEN
            BEGIN
              Write('Handle is ', handle);
              Write(' BUFFER starts at ', R_Offs);
              Write(' size is ', R_Size);
              WriteLn(' pointer is at ', R_Ptr);
              IF Char_Waiting IN F.Flags THEN
                Write('CHAR waiting is ', chBuff, '');
              ELSE Write(' NO char waiting');
            END
          END
        END
      END
    END
  END.

```

(continues)

Figure 6: More information from the File Information Block of a Turbo text file.

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## ■ TURBO POWER USER

program of my own (shown in Figure 6) that demonstrates some of the other goodies that can be found in the File Interface Block. The file handle is there, as is the complete path name under which the file

was opened. And a "flags" byte tells whether the file in question is a true disk file or is instead a DOS device. The flags byte also tells you if the file is open for input, output, or both.

```

      Write('The file is not yet open.'):
      END;
      3 : Write(' COM: device');
      2 : Write(' XBD: device');
      3 : Write(' LST: device');
      4 : Write(' AUX: device');
      5 : Write(' USB: device');
      END;
      IF Out_Okay IN F.Flags THEN Write(' Open for output.'):
      IF In_Okay IN F.Flags THEN Write(' Open for input.'):
      WriteLn WriteLn;
      END;
      END;
      BEGIN
      ClrScr;
      Assign(TF1, 'FILEINFO.PAS');
      WriteLn('===== REPORT on an un-opened file');
      File_Report(TF1);
      Reset(TF1);
      WriteLn('===== REPORT on an opened file');
      File_Report(TF1);
      Assign(TF2, 'FILEINFO.PAS');
      Reset(TF2);
      IF IOF(TF2) THEN
      WriteLn('===== REPORT after a dummy call to "IOF"');
      File_Report(TF2);
      Assign(TF3, 'SomeDumb.fil');
      Rewrite(TF3);
      WriteLn('===== REPORT on a newly created file');
      File_Report(TF3);
      WriteLn('===== REPORTS on I/O devices');
      VAR centry, tnp : Integer;
      BEGIN
      File_Report(Lst);
      File_Report(Rnd);
      File_Report(Output);
      END;
      END.
  
```

(Figure 6 ends)

```

PROGRAM day_of_week;
TYPE string = STRING[15];
CONST
  Months : STRING[12] = 'JanFebMarAprMayJunJulAugSepOctNovDec';
  days : STRING[15] = 'SunMonTueWedThursFriSat';
VAR
  Mo, Da, Yr : Integer;
  day, date : string;
FUNCTION Zval(n : Integer) : string;
  (The function Zval returns the string equivalent of an integer)
VAR tmp : string;
BEGIN
  Str(n, tmp);
  Zval := tmp;
END;
PROCEDURE SetDate_Formula(VAR MM, DO, YF : Integer; VAR vday : string);
BEGIN
  IF MM < 3 THEN MM := MM+10
  ELSE MM := MM-2;
  IF MM > 12 THEN YF := YF-1;
  century := YF DIV 100;
  YF := YF MOD 100;
  tmp := Trunc((2.6*MM-9.2)+DO*YF+4)-(century DIV 4)-(12*century);
  tmp := (tmp+77) MOD 7;
  vday := Copy(days, 1+tmp*3, 3);
END;
BEGIN
  WriteLn('Enter month, day, year -- e.g. "3 4 1776"');
  ReadLn(MO, DA, YF);
  date := Copy(Months, 3*MO-2, 3) + ' ' + Zval(DA) + ' ' + Zval(YF);
  SetDate_Formula(MO, DA, YF, day);
  WriteLn(date, ' is a ', day);
END.
  
```

Figure 7: A procedure to determine the day of the week for any date from 1600 to 4000, using the Zeller approach.

## TURBO DATING

I've often wondered how programs like 1-2-3 or SideKick were able to determine the day of the week for a given date. I found the answer in one of Peter Norton's books. DOS function 52A returns the day of the week. However, this function works only for the current system date, between 1980 and 2099. My program uses Turbo to work out the day of the week for any date from 1600 to 4000.

Kenny Hew  
Inglewood, California

The procedure shown in Figure 7 is a somewhat modified version of Mr. Hew's program. Rather than use a CASE statement for the days' names, as Mr. Hew did, I'm simply copying the appropriate rhank of a string constant, instead. I have also

■ The whole point of the standard Zeller procedure is to work with dates beyond those DOS can handle.

removed the code that checked the current DOS date, since the whole point of the standard Zeller procedure embodied here is to work with dates beyond those DOS can handle.

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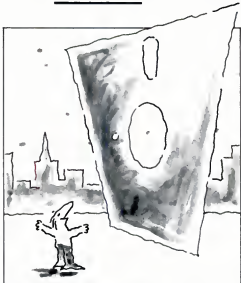
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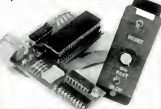
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### ■ USER-TO-USER

```

initialize:
    mov     bx,cx
    mov     dx,bx
    mov     al,DOS_video_io    ; get the video_io vector
    mov     eh,get_vector
    int     DOS_function
    mov     video_io,bx        ; end store it
    mov     bx,cx
    mov     dx,bx
    mov     dx,offset printer_interceptor
    mov     e1,DOS_printer_io
    mov     ah,set_vector
    int     DOS_function

    mov     bx,cx
    mov     dx,bx
    mov     dx,offset initialize
    int     DOS_terminate_resident ; terminate end remain resident

CSRG ENDS
END START
    
```

(Figure 2 ends)

the keyboard and set ERRORLEVEL accordingly to provide batch file branching. However, in each case you have to precede the keyboard-reading program with an ECHO statement prompting the user to strike a particular key.

The ASK.COM program, created by the ASK.SCR script as shown in Figure 3,

■ **ASK.COM** ANDs each input character to make entries case insensitive, and it echoes keystrokes (in the uppercase version) to the screen.

combines ERRORLEVEL setting and user prompting in a single command. Use a pure ASCII word processor or the DOS COPY CON command to create the ASK.SCR file. Leave a blank line above RCX, and hit the Enter key after each line, especially the last one (with the Q).

Then get into DOS, put ASK.SCR on the same directory as DEBUG, and type

DEBUG < ASK.SCR

(Or you could create ASK.COM by running the BASIC ASK.BAS program in Figure 4.)

```

N ASK.COM
A 100
XOR     BH,BH
MOV     BL,[0000]
MOV     DI,BX
ADD     DI,0001
MOV     AL,20
STOSB
STOSB
MOV     AL,24
STOSB
MOV     DX,0002
MOV     AH,09
INT     21
MOV     AH,08
INT     21
AND     AL,DF
PUSH    AX
CMP     AL,59
JZ      013D
CMP     AL,4E
JZ      0131
MOV     DL,AL
MOV     AH,02
INT     21
JMP     014B
MOV     DL,AL
MOV     AH,02
INT     21
MOV     DL,6F
INT     21
    
```

(continues)

**Figure 3:** ASK.SCR script to create ASK.COM ERRORLEVEL setter/prompter. Type it all using a pure ASCII word processor. Hit Enter at the end of each line (especially the last); leave a space above RCX. Put ASK.SCR and DEBUG.COM (Version 2.0 or later) on your disk; type DEBUG < ASK.SCR.

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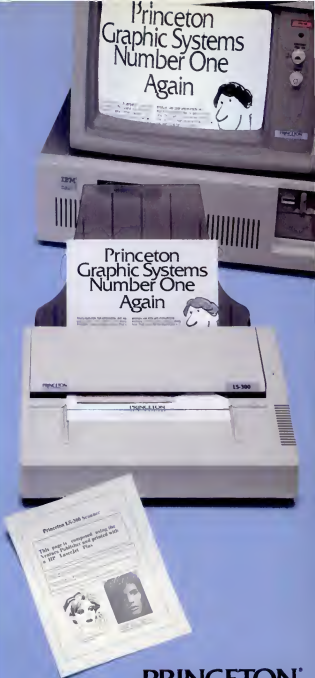
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## ■ USER-TO-USER

```

JMP      #14B
MOV      DL,AL
MOV      AH,#2
INT      21
MOV      DL,65
INT      21
MOV      DL,73
INT      21
MOV      DL,#D
INT      21
MOV      DL,#A
INT      21
MOV      DX,8888
POP      AX
MOV      AH,31
INT      21

```

```

RCX      5B
W
Q

```

(Figure 3 ends)

```

100 ' Program for creating ASK.COM -- by Van Seiner
110 CLS:PRINT "Checking DATA; please wait..."
120 FOR B=1 TO 6:FOR C=1 TO 17:READ A$:IF C<17 THEN 140
130 S=VAL(A$)
140 NEXT:NEXT:IF S=18336 THEN RESTORE:GOTO 160
150 PRINT "ERROR IN A BIG NUMBER AT END OF DATA STATEMENT":END
160 FOR B=1 TO 6:FOR C=1 TO 16:READ A$:T=VAL("6B*A$"):NEXT
170 READ #1:IF B=7 THEN 180 ELSE PRINT "ERROR IN LINE":B=18+218:END
180 T=B:NEXT:RESTORE:OPEN "ASK.COM" AS #1 LEN=1:FIELD #1,1 AS D$
190 FOR B=1 TO 6:FOR C=1 TO 16:READ A$
200 LSET D$=CHR$(VAL("6B*A$")):PUT #1:NEXT:READ DUMMYS:NEXT
210 CLOSE:PRINT "ASK.COM CREATED"
220 DATA 36,PP,BA,18,88,88,89,DP,81,C7,81,88,88,29,AA,AA,1964
230 DATA 88,24,AA,BA,82,88,84,89,CD,21,84,88,CD,21,24,DP,1818
240 DATA 58,3C,59,74,18,3C,4E,74,88,88,C2,84,82,CD,21,EB,1616
250 DATA 1A,88,C2,84,82,CD,21,82,6F,CD,21,EB,8E,88,C2,84,2862
260 DATA 82,CD,21,82,65,CD,21,82,73,CD,21,82,8D,CD,21,82,1895
270 DATA 8A,CD,21,8A,88,88,58,84,31,CD,21,88,88,88,88,88,989

```

Figure 4: ASK.BAS to create ASK.COM program that both prompts the user and sets the ERRORLEVEL to allow batch file branching.


ASK.COM, like ECHO, prints the text following it on the same line. However, unlike ECHO, ASK.COM waits for the user to enter a keystroke. It ANDs each input character with DF to turn everything uppercase and make all entries case insen-

sitive, and it echoes the keystroke (in its uppercase version) to the screen. Also, it handles "y" and "n" specially, echoing "Yes" and "No."

ASK.COM won't check to see if a keystroke is valid; the program will happily

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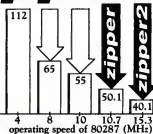


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## ■ USER-TO-USER

munch on anything you feed it from the keyboard. To modify the program so that it's case sensitive, replace the

AND AL,DF

at location 11E with two NOPs:

```
DEBUG ASK.COM
E 11E 90 90
W
Q
```

Use ASK.COM the same way you'd use ECHO. So if your batch file includes the line

ASK Want to back up your files (Y/N)?

ASK will display the line

Want to back up your files (Y/N)?

on-screen and wait for a reply. You can

then test the ERRORLEVEL in a series of IF statements. The CHECK.BAT batch file below shows how to stack the IF ERRORLEVEL tests.

```
ECHO DFF
:BADCHAR
ASK Do you want to run CHECK (Y/N)?
IF ERRORLEVEL == 98 GOTO BADCHAR
IF ERRORLEVEL == 99 GOTO BUNCH
IF ERRORLEVEL == 79 GOTO BADCHAR
IF ERRORLEVEL == 78 GOTO GOODCHAR
GOTO BADCHAR
:GOODCHAR
ECHO You didn't want to run it
GOTO END
:BUNCH
CHECK
:END
```

This batch file will ask if you want to run CHKDSK; if you answer "N" or "n", it will echo "No" to the screen and jump to the message saying you didn't want to run it. If you answer "Y" or "y", it will jump to the CHKDSK command near the bottom and execute it.

Yan Seiner  
Princeton, New Jersey

*Putting so many ERRORLEVEL tests into a batch file is cumbersome, but this beats not being able to branch in a batch file. This short program saves steps and*

■ ASK.COM won't check to see if a keystroke is valid; the program will happily munch on anything you feed it from the keyboard.

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*If you experience this, use DEBUG to patch your SK.COM. Make sure DEBUG*

■ There's an easily repaired divide overflow bug when you run the SideKick calculator on an AT.

*.COM and a copy—not your original—of SK.COM are in the same directory or are properly PATHed to, and type*

DEBUG SK.COM

*Then, when you see the DEBUG "..." hyphen prompt, type*

S 100 L9A00 2 FE CB


*DEBUG should respond with two four-digit hex numbers separated by a colon, something like 2F8A:70B8. Ignore the leftmost four. But enter the rightmost four in the place of the xxxx below:*

E xxxx 2 B0 63

*(You'd type E 70B8 2 B0 63, for example, if DEBUG reported 2F8A:70B8.)*

*Finally, type W and then hit Enter to write the patch, and then type Q and hit Enter to quit DEBUG. You'll have to reboot your system to load the patched copy.*

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# PC TUTOR

*How to program software to determine what hardware is being used; and how to use the above-640K memory you bought with your AT.*

## AT MEMORY ABOVE 640K

I recently bought an AT clone with 1 megabyte of memory. Unfortunately, DOS seems to recognize only 640K of this memory. What is so special about the memory between 640K and 1 megabyte? My vendor charged extra for it, so I assume that I should be able to use it for something.

Mike Morris  
Pasadena, California

The extra 384K of memory in your machine is called "extended memory," and it can be accessed only by the 80286 microprocessor in the PC AT and compatibles.

I think what's confusing you (as well as lots of other people) is that when the manufacturer or dealer says "1 megabyte of memory" it sounds like this megabyte is in one continuous block. It's not. 640K of this memory sits at the bottom end of the microprocessor's address space, to be used by DOS and applications programs. The extra 384K does not directly continue from this lower 640K.

The total addressing space of the 8088 microprocessor used in the PC and PC-XT is 1 megabyte. The lowest 640K is random access memory that can be used by DOS, the next 128K is reserved for video boards, and the highest 256K is reserved for ROM BIOS chips.

The 80286 microprocessor in the PC AT and compatibles usually works in real mode, which is compatible with the 8088 microprocessor and can access the same 1 megabyte of memory. Once again, the lower 640K is used by DOS and applica-

tions programs. When switched to protected mode, however, the 80286 can address an additional 15 megabytes of extended memory.

This is shown in Figure 1. The extra 384K of memory you have in your machine sits at the low end of the extended memory region, above the 1-megabyte address range of the 80286 microprocessor when

this chip is operating in real mode.

Because of significant differences between real mode and protected mode, current versions of DOS and current programs cannot use this additional 15 megabytes of extended memory. Getting access to it will require the greatly enhanced operating system that is expected from Microsoft sometime this year.

Right now, however, you can use your extra 384K of memory for a RAMdisk by using the VDISK.SYS device driver included with PC-DOS 3.0 or later. Put the following line in your CONFIG.SYS file:

DEVICE=VDISK.SYS 384 /E

The VDISK driver uses a BIOS call to switch temporarily to protected mode, access the extended memory, and then switch back to real mode.

Recently, several products have become available that let you use extended memory to emulate the expanded memory that conforms to the Lotus/Intel/Microsoft expanded memory specification. Such memory is usable with programs like Lotus's 1-2-3, Release 2, Symphony, and other integrated programs and spreadsheets. Reviews of some of these products appear in "Emulating Expanded Memory: Five Software Alternatives," PC Magazine, Volume 6 Number 6.

## DOS AND DISK DRIVES

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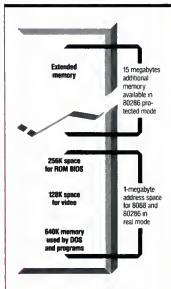


Figure 1: This memory map of the PC AT shows how extended memory sits above the 1-megabyte address space normally associated with the PC and PC-XT.



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## ■ PC TUTOR

```

CheckDrive:  Mov  DX, AX      ; drive to check
              Mov  AH, 19h    ; get default drive
              Int  21h
              Push AX          ; original drive
              Mov  AH, 0Eh    ; change drive
              Int  21h
              Mov  AH, 19h    ; get default drive
              Int  21h
              Sub  DL, AL      ; zero if drive OK
              Mov  CH, CH     ; save diff. in CH
              Pop  DX          ; original drive
              Mov  AH, 0Eh    ; restore drive
              Int  21h
              Mov  AX, CX     ; return code
              Ret
    
```

**Figure 2:** A short assembly language routine to check the validity of a particular disk drive.

will figure out what hardware is installed on the computer. Amazingly, even though DOS is a Disk Operating System, some of our biggest problems involve disk drives.

For example, if an XT or AT has only one floppy disk drive, then the same drive is used for both A: and B:. How can we determine from a program that this is the case? How can we determine the type of drive (360K, 720K, 1.2-megabyte)? Even determining which drive letters are valid seems to be difficult. What are the answers here?

Randal K. Bond  
West Lafayette, Indiana

*As you have found, this is not a simple subject. Unfortunately, much of the crucial information about logical disks and physical disk drives remains undocumented by Microsoft. Microsoft Windows and even stalwart programs like CHKDSK use undocumented DOS function calls when dealing with disk drives. The rest of us must work in a fog.*

*The subject has become still more complex with recent versions of DOS, for now you must worry about network drives, drives that are really subdirectories mapped into drive letters with the SUBST command, and drives that have been joined to other drives with the JOIN command.*

*First, however, let's attack the problem of determining which drive letters are val-*

*id. I'll assume you have a copy of IBM's Disk Operating System Technical Reference. The most recent edition covers DOS versions from 2.1 through 3.2.*

*One fairly obvious way to determine which disk drive letters are valid is to use interrupt 21h function call 0Eh (Select Disk) repeatedly for all drives from A*

■ Unfortunately, much of the crucial information about logical disks and physical disk drives remains undocumented by Microsoft.

*through Z. This function call does not return an error code, so to determine if DOS really changed the default drive you have to use interrupt 21h function call 19h (Current Disk). If the current disk has been changed to the disk specified when using the Select Disk function call, then the drive letter is valid.*

*Figure 2 shows a short assembly language procedure to do this. It takes a disk drive code in AL (0 = A, 1 = B, etc.) and*



## ■ PC TUTOR

returns AX equal to 0 if the drive is valid or to nonzero if the drive is invalid. Although the procedure changes the default drive in the course of the routine, it restores the original default drive before exiting.

The value of AL returned from function call 0Eh supposedly reflects the "total number of drives." Disregard this. Under DOS 3.0 and later, it always returns at least 5. If you have the statement

LASTDRIVE=Z

in your CONFIG.SYS file, AL returns 26. Obviously, most of these drives will not be valid.

COMMAND.COM uses a different method of determining if a drive is valid when you want to change the default drive from the DOS command level. COMMAND.COM uses the more obscure interrupt 21h function call 29h (Parse Filename). It sets up a command line with the drive letter, makes the function call, and then checks the value of AL. If AL is FFh, then the drive is not valid.

Next, you have the problem with drive letters A: and B: when only one floppy diskette drive is installed in the system. Drives A: and B: are called "logical" drives that use the same "physical" drive—the single floppy disk drive.

An easy way to determine if the computer has one diskette drive (in which case A: and B: refer to the same drive) or more (in which case A: and B: are separate drives) is to use interrupt 11h, the BIOS Equipment Check. (The BIOS interrupts are documented in separate IBM Technical Reference manuals for each member of the PC family.) This interrupt returns a bunch of information encoded in register AX. Bits 7 and 6 (the least significant bit being bit 0) indicate the number of diskette drives, where 00 is 1, 01 is 2, 10 is 3, and 11 is 4.

This assembler subroutine will return AX equal to the number of diskette drives:

NumFloppies:	Int	11h
	Mov	CL, 6
	Shr	AX, CL
	And	AX, 3
	Inc	AX
	Ret	

DOS 3.2 includes a device driver called DRIVER.SYS, which allows a user to create a logical drive that uses the same physical drive as another drive letter. This is used primarily when installing a 3½-inch diskette drive on an existing system. If you need to copy files from one 3½-inch diskette to another, the best way to do it is to have two logical drives for the same physical drive. DRIVER.SYS essentially allows you to do for other drives what DOS does automatically for a system that contains only a single floppy diskette drive.

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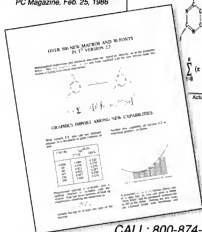
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Fortunately, DOS 3.2 also includes an expanded IOCTL call (interrupt 21h function call 44h) that can help in providing your programs with this information. For example, when using this function call with AL equal to 0Eh, you can determine for each drive letter if another logical drive letter uses the same physical drive. You can also determine the last drive letter that was used to reference that physical drive.

If a program attempts to use a logical drive that refers to a physical drive last accessed with another logical drive letter, the message "Insert diskette for drive X: and strike any key when ready" will splat-

■ You can determine if another logical drive letter uses the same physical drive.

ter across your screen. You can avoid this message by setting the drive using the IOCTL call with AL equal to 0Fh.

The DOS 3.2 IOCTL call again comes to the rescue when you want to determine the "device parameters." These device parameters indicate the type of diskette drive installed (normal 5¼-inch, high-density 5¼-inch, 3½- or 8-inch; fixed disk or tape drive), along with other information. You can get either the default drive parameters or the drive parameters that apply to the disk currently in the drive (if, for instance, there is a 360K floppy in a 1.2-megabyte diskette drive).

Thus, if you want to upgrade all your machines to DOS 3.2, you'll probably be in good shape with this expanded IOCTL function call. It's only in DOS 3.2 that sufficient information is available (and documented) to allow your programs to determine disk drive configurations.

## ASK THE TUTOR

The PC Tutor solves practical problems and explains points of general interest. To see your questions answered here, drop a line to PC Tutor, PC Magazine, One Park Avenue, New York, NY 10016

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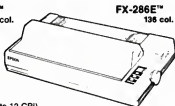
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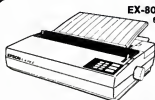


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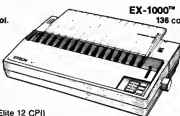


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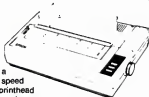
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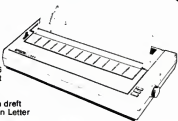
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- 2) Your primary job function is (check)

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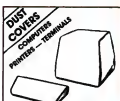
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## CONNECTIVITY RETROSPECTIVE

As our year-long connectivity series continues, author Frank J. Derfler, Jr., takes time out to recap the information he has presented and the conclusions he has reached. Local area networks from AT&T, Fox Research, Gateway Communications, IBM, Novell, Proteon, Standard Microsystems, Talgrass, Texas Instruments, Orchid Technologies, 3Com, and Invisible Software are highlighted.

## WORD PROCESSOR UPDATE

Once you get to the top, how do you stay there? By improving yourself again and again. Merv Adrian sorts through all the confusion about decimal-point updates and reports the up-to-the-minute status of MultiMate, Microsoft Word, IBM DisplayWrite, OfficeWriter, WordPerfect, and XyWrite.

## SECURITY THE HARD WAY

Everyone is familiar with the various ways that software security programs can protect your PC's files, but designers of hardware security methods haven't been idle. Richard Aarons looks at a number of gadgets, from sophisticated encryption cards to good old locks and keys, that will fortify your computer.

**10-MHz COMPUTERS** There is a new category of AT compatibles emerging: the 10-MHz machine. Winn L. Rosch reviews the latest from PC's Limited, Kaypro Corp., Computer Direct, AST Research, and Proteus.

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<div style="text-align: center;"> <b>W.C. PROPERTIES</b>  <b>CHRYSLER FINANCIAL CORP. - W.C. SUBST</b>  <b>AS OF JANUARY 31, 1984</b> </div>	
<div style="text-align: center;"> <b>ASSETS</b> </div>	
<b>CURRENT ASSETS</b>	
Cash and interest-bearing deposits	\$30,000
Accounts Receivable - net	\$54,211
Notes due	779,121
Loans receivable	2,881
Deferred charges	11,143
Deposits	30,480
Prepaid expenses and other current assets	43,664
<b>TOTAL CURRENT ASSETS</b>	<b>\$911,080</b>
<b>FIXED ASSETS</b>	
Plant and equipment and other equipment	210,468
Depreciation	(86,204)
Land	87,478
Landheld for improvement	20,281
	<b>(283,047)</b>
Less Accumulated depreciation and amortization	(24,943)
<b>FIXED ASSETS - NET</b>	<b>623,602</b>
<div style="text-align: right;"> <b>\$1,534,682</b> </div>	



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